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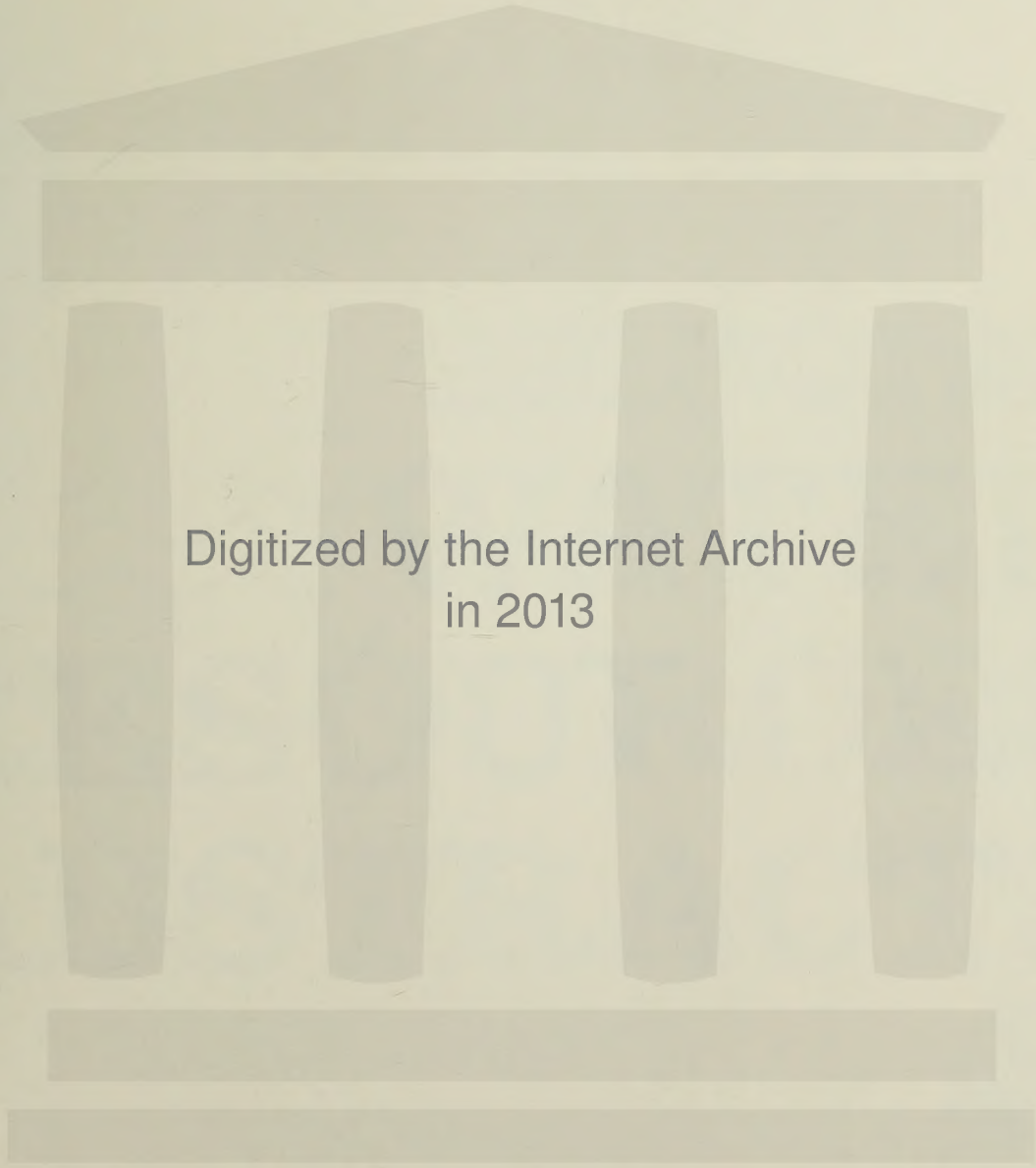
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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 3, NUMBER 1
JANUARY 1, 1970

W70-00001 -- W70-00417

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 1
JANUARY 1, 1970

W70-00001 -- W70-00417

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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05 WATER QUALITY MANAGEMENT AND PROTECTION
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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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08 ENGINEERING WORKS
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09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

THE STRUCTURE AND PROPERTIES OF WATER,
D. Eisenberg, and W. Kauzmann.
New York, Oxford Univ Press, 1969. 296 p, 70 fig, 44 tab, 403 ref.

Descriptors: *Water structure, *Water properties, *Thermodynamics, Physical properties, Water vapor, Hydrogen bonding, Molecular structure, Electrical properties, Electrical studies, Spectroscopy, Optical properties, Nuclear magnetic resonance, X-ray diffraction, Infrared radiation, Analytical techniques, Reviews, Bibliographies.
Identifiers: *Water physical properties.

Some of the most important data on the nature and properties of water are summarized and the theories that are most effective in correlating these data are presented in a textbook intended for the scientist familiar with basic physical chemistry. The relationship of water structure to water properties is explained. Infrared and Raman spectra are covered in detail because they reveal so much about ice and liquid water structures. Other techniques of study including thermodynamics, spectroscopy, electrical studies, NMR, optics, X-ray diffraction, and vibrational spectroscopy are discussed and their findings are related to structural properties. Liquid water and water vapor models are presented. An extensive bibliography consists largely of recent works but also includes many older papers. (Knapp-USGS)
W70-00242

1B. Aqueous Solutions and Suspensions

THE STRUCTURE AND PROPERTIES OF WATER,
For primary bibliographic entry see Field 01A.
W70-00242

THE FORMATION OF PYRITE FROM HYDRATED IRON OXIDE IN AQUEOUS SOLUTION AT 20 DEGREE C,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Baas-Becking Geobiological Lab.
William M. B. Roberts.
Mineral Deposita (Berlin), Vol 3, No 4, p 364-367, Dec 1968. 4 p, 1 tab, 8 ref.

Descriptors: *Pyrite, *Hydrates, *Suspension, *Iron oxides, *Aqueous solutions, Temperature, Atmospheric pressure, Hydrogen sulfide, Oxygen, Anaerobic conditions, Sediments, X-ray diffraction, Mineralogy.
Identifiers: Pyrite formation in aqueous solution.

Experiments conducted by the Baas-Becking Geobiological Research Laboratory of Australia on the formation of pyrite from hydrated iron oxides and sulfides in aqueous solutions are described. In carrying out the experiments, oxygen was rigorously excluded from the system and the pH was 5.6. During a later aging period a reaction takes place in which iron monosulfide is converted to pyrite at pH 5.85. The results confirm Berner's conclusions that pyrite will form during the sedimentary cycle in an anaerobic environment such as studies made on sediments from the Black Sea, and tidal flats of the Netherlands and off Massachusetts had indicated. (Gabriel-USGS)
W70-00244

02. WATER CYCLE

2A. General

ANALYSIS OF TWO MAJOR RUNOFF-PRODUCING SOUTHWEST THUNDERSTORMS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
H. B. Osborn, and K. G. Renard.
J Hydrol, Vol 8, No 3, p 282-302, Jul 1969. 21 p, 20 fig, 1 tab, 5 ref.

Descriptors: *Rainfall-runoff relationships, *Thunderstorms, *Storm structure, Arizona, Isohyets, Hyetographs, Hydrographs, Storm runoff, Runoff forecasting, Meteorlogy, Demonstration watersheds, Small watersheds.
Identifiers: Walnut Gulch Experimental Watershed.

The two largest runoff-producing storms for 10 yr of records, the first in 1964 and the second in 1967, recorded on the Walnut Gulch Experimental Watershed in southeastern Arizona are analyzed and compared. Both storms were non-frontal thunderstorms which produced peak discharges on the order of 1500 cfs per sq mi; in 1964 from a 2000-acre subwatershed, and in 1967 from an 84-acre subwatershed. During the 1967 storm rainfall of 3.35 inches in 45 min was recorded at one point on the watershed. Approximately 18 acre-ft of runoff was produced on the 84-acre subwatershed in the 1967 storm. Runoff-producing rainfall lasted for less than 60 min for both storms. For both storms, runoff per unit area decreased with increasing subwatershed size because of the large transmission losses in the ephemeral channels and because of the limited areal extent of the runoff-producing rainfall. (Knapp-USGS)
W70-00037

A WATERSHED FLOW MODEL OF STOCHASTIC STRUCTURE,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Harsha Desai, and David L. Raphael.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, p 59-73, 1967. 15 p, 5 fig, 4 tab, 5 ref.

Descriptors: *Streamflow forecasting, *Routing, *Statistical models, *Hydrographs, *Synthetic hydrology, *Markov processes, Stochastic processes, Rainfall-runoff relationships, Computer models.
Identifiers: Watershed models.

A model was developed to predict the surface flow resulting from precipitation during a given time period, using simpler computations than was possible with conventional methods. It was assumed that surface flow due to rainfall would approach that of an absorbing Markov chain process. The various transfer coefficients or probabilities can be estimated and a starting state can be specified. These transfer coefficients may not remain constant for the entire time interval in a hydrologic cycle under study, due to the varying soil moisture conditions, varying precipitations, and varying climate. To make some provision for this, the transfer coefficients were estimated as an average for the total time period. Except for the initial time period of 2 days, the estimated flows were very close to the actual flows. In its application to the Susquehanna River Basin, the model used only 1 absorbing state due to the lack of sufficient data. The model was also able to give the total response behavior of the system as a whole. It was possible to estimate the amounts lost to the 3 absorbing states from the system during the total time period. (Knapp-USGS)
W70-00053

MATHEMATICAL SIMULATION OF A STREAM-AQUIFER SYSTEM,
Colorado State Univ., Fort Collins.
Robert A. Longenbaugh.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 74-83, 1967. 10 p, 7 fig, 8 ref.

Descriptors: *Conjunctive use, *Optimization, *Simulation analysis, *Model studies, *Computer models, Computer programs, Surface-groundwater relationships, Water levels, Water level fluctuations, Water utilization.
Identifiers: Watershed models, Arkansas River Valley (Colo).

A generalized digital computer program has been developed to simulate the conjunctive use of surface and groundwater in a stream-aquifer system. The model was adapted to the 25-mile reach of the Arkansas River Valley between La Junta and Las Animas, Colorado. Water table fluctuations in the aquifer and water exchange between the river and aquifer were studied with time. Variables considered include water applied within the area as irrigation; recharge due to precipitation; withdrawals from the aquifer by pumps and phreatophytes; and the geologic parameters of permeability, storage coefficient, bedrock elevation, and initial amount of water in storage. A comprehensive hydrologic evaluation of the study reach by the U. S. Geological Survey provided data used in verification of the model. Only a 12 month period from Oct 1, 1963, to Oct 1, 1964, was simulated, but experience with the model indicated satisfactory verification was obtained. The modeling of groundwater systems with digital computers provides flexibility, rapid analyses and an economical approach. Use of digital computer models in making administrative decisions and for optimization of the water resources is expected. (Knapp-USGS).
W70-00054

THE MECHANICS OF SURFACE RUNOFF,
Florida Univ., Gainesville. Dept. of Bioenvironmental Engineering.
For primary bibliographic entry see Field 02E.
W70-00055

THE USE OF THE SHALLOW WATER EQUATIONS IN RUNOFF COMPUTATION,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering; and Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
James A. Liggett, and David A. Woolhiser.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 117-126, 1967. 10 p, 4 fig, 6 ref.

Descriptors: *Mathematical studies, *Rainfall-runoff relationships, *Runoff forecasting, *Unit hydrographs, *Routing, Hydrograph analysis, Synthetic hydrology, Overland flow, Channel flow, Streamflow forecasting.
Identifiers: *Watershed models, Kinematic wave theory.

The runoff process is extremely complex and cannot be described mathematically now or in the foreseeable future. The shallow water equations provide the closest description available, but the solution to these nonlinear equations appears to be too complex to gain general popularity, at least as far as the small drainage area is concerned. (The river problem seems to be easier to describe by data input to standard programs.) However, solutions to the shallow water equations provide insight into the physical process and aid in evaluating less complex models. The shallow water equations have indicated the important parameters in the overland flow problem. They indicate the degree of approximation in the easier kinematic wave solution. In a like manner they can indicate the strengths and weaknesses of any other method. Many aspects of the runoff process are stochastic. For example the exact stream or rivulet pattern can probably never be described deterministically. Also because the

input to a hydrologic system (rainfall) is stochastic, the output (streamflow) can only be described in terms of its probability laws. However, it is reasonable to separate and study those parts of the process that are deterministic for these are the components subject to control by engineering works or agricultural practices. (Knapp-USGS)
W70-00056

WATERSHED HYDRAULICS IN THE LABORATORY,
Missouri Univ., Rolla. Dept. of Civil Engineering.
Terence E. Harbaugh.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 500-513, 1967. 14 p, 5 fig, 19 ref.

Descriptors: *Model studies, *Hydraulic models, *Rainfall-runoff relationships, Routing, Time of concentration, Overland flow, Unit hydrographs, Time lag, Rainfall intensity.
Identifiers: Watershed models.

Laboratory facilities are basic ingredients in the understanding of the hydromechanic behavior of natural watersheds. The significant variables which influence time of concentration, time to equilibrium, time to peak, lag time, etc., are readily observable, thus providing an insight into the hydromechanic behavior of watersheds. This paper is devoted to a discussion of the characteristics of the time distribution of runoff (hydrography) with comments on lag time, time to peak, and other characteristics time responses of watersheds. Various definitions concerning the concept of time of concentration exist in hydrologic literature. Its general definition as the time it takes a drop of water to travel from the uppermost part of the watershed to the outlet is shown to be in direct contradiction to its definition as the time it takes a watershed to attain maximum discharge when subjected to a constant intensity rainfall. (Knapp-USGS)
W70-00065

PREDICTION OF SOIL AND WATER LOSSES,
Agricultural Research Service, Tifton, Ga. Soil and Water Conservation Research Div.; and Agricultural Research Service, Athens, Ga. Soil and Water Conservation Research Div.
Adrian W. Thomas, and John R. Carreker.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 514-523, 1967. 10 p, 1 fig, 10 tab, 12 ref.

Descriptors: *Water loss, *Soil erosion, *Consumptive use, *Evapotranspiration, Hydrologic budget, Water balance, Statistical methods, Regression analysis, Weather, Climates, Erosion, Rainfall-runoff relationships, Forecasting, Souteast U.S., Coastal plains.
Identifiers: Southern Coastal Plain.

Methods are presented for estimating water loss and consumptive use in the Southern Coastal Plain. Soil and water losses were measured from two fallow plots during a 7-yr period, 1960-1966. The average rainfall of 48.53 inches had an average EI value of 373, which was close to the long-time average of 350. The plots were on Tifton loamy sand with 3% slope, 83 ft in length and 1/20 acre in size. A stepwise regression analysis of rainfall parameters was made on a storm and annual basis for soil and water losses. For the storm basis, EI explained 52% of the variation of soil loss. A maximum percentage of 66% was found with 14 parameters, and an equation was written with 6 parameters explaining 64% of the variation in soil loss. For the annual basis, the maximum 30 min intensity explained 82% of the variation for soil loss. An equation was written with 5 parameters that explained 97% of the variation in soil loss. The kinetic energy explained 63% of the variation of water loss for the storm basis. A maximum percentage of 71 was obtained from all the parameters; however, 5 parameters gave an equation for predicting water loss with 69% of the variation explained. For the annual basis, the maximum 30-min intensity explained 79% of the variation in water loss, and a prediction equation with 5 parameters was written that explained 96% of the variation. These prediction equations should be helpful in planning conservation practices in the Southern Coastal Plain. (Knapp-USGS)
W70-00066

ANALOG-DIGITAL MODELS OF STREAM-AQUIFER SYSTEMS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W70-00204

WINTER CIRCULATION IN THE GULF OF ALASKA,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 02L.
W70-00220

THE CHANNELIZED FLOW OF TURBIDITY CURRENTS WITH APPLICATION TO MONTEREY DEEP-SEA FAN CHANNEL,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02L.
W70-00223

VARIATIONS OF RAINFALL FREQUENCY IN RELATION TO DROUGHT ON THE EAST COAST,
Ministry of Works, Napier (New Zealand).
P. J. Grant.
J Hydrol, New Zeal, Vol 7, No 2, p 124-135, 1968. 12 p, 2 fig, 6 tab, 14 ref.

Descriptors: *Droughts, *Rainfall, *Climatology, Statistical methods, Weather, Precipitation (Atmospheric), Runoff forecasting, Infiltration, Rainfall-runoff relationships.
Identifiers: *New Zealand, Rainfall frequency, Rainfall effectiveness index.

Daily rainfall frequencies in New Zealand were analyzed using consecutive-year plots and cumulative-departure curves. It is shown that since the end of the 19th century there have been pronounced periodic changes in the frequencies of the larger daily rains. In spring, summer and autumn - winter was not analyzed in detail periodic mean rainfall, since 1890, is positively related to both frequency and percentage contribution of rains greater than 1.50 inches. Mean periodic rainfall effectiveness (R.E.) indices are presented. Abrupt decreases of R.E., or increases in drought severity, occurred in spring and summer during 1905-6, and in autumn about 1911. A further abrupt increase in drought severity occurred in spring about 1920. In summer, the most droughty period of this century was 1946-58; for autumn the current period since 1958 is the most droughty. Some of these changes of R.E. probably have practical significance, especially in relation to tree growth and some aspects of streamflow. The connection between frequency changes of the larger rains and changes of atmospheric circulation is briefly discussed. (Knapp-USGS)
W70-00256

A MATHEMATICAL CATCHMENT MODEL FOR ESTIMATING RUNOFF,
Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering.
W. C. Boughton.
J Hydrol, New Zeal, Vol 7, No 2, p 75-100, 1968. 26 p, 9 fig, 8 tab, 20 ref, 1 append.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Mathematical models, *Simulation analysis, Computer programs, Digital computers, Hydrograph analysis, Synthetic hydrology, Hydrologic budget, Water balance, Evapotranspiration, Water storage, Infiltration.
Identifiers: Watershed models.

The development of mathematical catchment models from past studies of catchment water balance is reviewed. The structure and operation of a catchment model which uses daily rainfalls to estimate daily volumes of runoff is described. A steepest-ascent method for evaluating variables in the model is described and the results obtained with the model on 5 catchments in New Zealand are reported. Computer program listings and instructions for use of the model are included. The basis of the model is a water balance between input as rainfall; output as evapotranspiration, runoff, and infiltration; and change in storage. The model simulates continuous catchment behavior, in drying as well as runoff, rather than simulating only storage-delay behavior. (Knapp-USGS)
W70-00257

2B. Precipitation

ANALYSIS OF TWO MAJOR RUNOFF-PRODUCING SOUTHWEST THUNDERSTORMS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 02A.
W70-00037

THIESSEN COEFFICIENTS BY A MONTE CARLO PROCEDURE,
Technion - Israel Inst. of Tech., Haifa. Hydraulic Lab.
For primary bibliographic entry see Field 07B.
W70-00039

WATER RESOURCE OBSERVATORY CLIMATOLOGICAL DATA WATER YEAR 1968.
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 07C.
W70-00138

ECOLOGICAL EFFECTS OF WEATHER MODIFICATION: A PROBLEM ANALYSIS.
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
For primary bibliographic entry see Field 06G.
W70-00140

THE ROUND TURBULENT JET IN A CROSS WIND,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 08A.
W70-00154

VARIATIONS OF RAINFALL FREQUENCY IN RELATION TO DROUGHT ON THE EAST COAST,
Ministry of Works, Napier (New Zealand).
For primary bibliographic entry see Field 02A.
W70-00256

2C. Snow, Ice, and Frost

COMPARISON OF MORAINES FORMED BY SURGING AND NORMAL GLACIERS,
Geological Survey of Canada, Calgary (Alberta).
Nathaniel W. Rutter.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 991-999, Aug 1969. 9 p, 8 fig, 2 tab, 18 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Glacial drift, *Stratigraphy, Ice, Movement, Rheology, Sediments, Deposition (Sediments).
Identifiers: Glacier surges, Moraines.

A Neoglacial moraine of Bighorn Glacier, St. Elias Mountains, Yukon, probably formed by a surging glacier, and a Neoglacial normal moraine of nearby Grizzly Glacier were studied. Surficial deposits and erosional features were mapped. Fabric analyses were done in till at 5 sites in each moraine. Samples

were subjected to laboratory lithologic and texture analyses. The Bighorn (surge) moraine is a thin, discontinuous, irregular mantle till, but including ice-contact stratified material. Lateral moraines show subdued ridges marking the upper limit of glaciation. Ground moraine of the Grizzly (normal) glacier is an irregular, continuous, thick mantle, mostly till and ice-contact stratified material. Upper ice limits are marked by prominent ridges. Rocks of similar lithologies within the till are concentrated in bands parallel to glacier flow. Stones in till of the Grizzly moraine have strong preferred orientation roughly in the direction of glacier flow. In the Bighorn moraine, rocks in till are weakly oriented. Where orientation is apparent, it is not necessarily in the flow direction. For the size fraction finer than 2 mm, Bighorn till is coarser than Grizzly till although the bedrock terrain is similar. These differences are useful in distinguishing moraines of normal and surging glaciers. (Knapp-USGS)
W70-00007

OBSERVATIONS OF THE SURGE OF STEELE GLACIER, YUKON TERRITORY, CANADA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
A. D. Stanley.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 819-830, Aug 1969. 12 p, 4 fig, 2 tab, 22 ref.

Descriptors: *Glaciers, *Flow, *Surges, Rheology, Ice, Movement, Regimen, Melting, Water, Climates, Temperature.
Identifiers: *Canada, *Yukon Territory, Steele Glacier, Glacier surges.

For part of 1966, Steele Glacier in the Icefield Ranges, Yukon Territory, Canada, made a spectacular advance at a rate exceeding 500 m per month. The main part of the surge continued for two yr, but by early 1968 the advance had slowed to less than one tenth of the maximum rate. For most of the 35-km length of the main trunk the surface was a chaotic jumble of ice blocks, spires, and pinnacles, but large structures outlined by surface moraine were preserved. Most of these structures had been displaced 8 km by August 1967, irrespective of their location. Preliminary measurements indicate structures were displaced similar distances down the length of the glacier and suggest that most of the glacier moved forward as a block. The surge has not been correlated with any local earthquake activity, and there is no evidence for a short-term climatic change. The movement is considered to result from critical dynamic conditions within the glacier, possibly facilitated by increased amounts of water along the ice-bedrock contact. (Knapp-USGS)
W70-00009

ICE-SHEET SURGES AND THE GEOLOGICAL RECORD,
Princeton Univ., N.J. Dept. of Geology.
John T. Hollin.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 903-910, Aug 1969. 8 p, 2 fig, 39 ref. NSF Grant No GA-3920.

Descriptors: *Glaciers, *Flow, *Surges, *Antarctic, *Paleoclimatology, Pleistocene epoch, Quaternary period, Movement, Ice, Rheology, Melting, Water, Climates, Temperature, Weather, Albedo.
Identifiers: *Ice caps, Paleoglaciology, Antarctic ice cap, Ice cap surges, Glacier surges.

If they had occurred, ice-sheet surges would have caused sea-level rises of up to 50 m from Gondwanaland and 20 m from Antarctica. The rises would have taken 100 yr or much less, and the subsequent falls would have taken 50,000 yr or so, as the ice built up again. Such rises may explain the extensive and sharp coal - marine shale contacts in the Carboniferous cyclothems. The chief rival explanation for these contacts is sudden subsidence. Tests should show (1) if such contacts are better correlated with periods of glaciation or with areas of tectonic activity, (2) how extensive the contacts really are, (3) if there is any evidence of erosion during sea-level falls, (4) if the amplitudes and periods of the cycles fit surges or subsidence, (5) how fast the submergences were, and (6) if any coolings began at the contacts. Wilson suggests that in the Pleistocene the surge coolings were sufficient to trigger the northern ice ages. If so, interglacial pollen profiles should show rapid but temporary marine transgressions beginning at the break of climate. Evidence suggesting such transgressions occurs in England and the United States, but is still insufficient to disprove explanations such as local downwarping. There is no evidence yet for surges in Wisconsin or Post-glacial time. There is some evidence that the Antarctic Ice Sheet is currently building up, but this could be a response to a Post-glacial accumulation increase rather than the prelude to a surge. (Knapp-USGS)
W70-00013

THE CLIMATIC EFFECTS OF LARGE-SCALE SURGES OF ICE SHEETS,
Victoria Univ., Wellington (New Zealand). Dept. of Chemistry.
A. T. Wilson.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 911-918, Aug 1969. 8 p, 10 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Antarctic, *Paleoclimatology, Pleistocene epoch, Quaternary period, Movement, Ice, Rheology, Melting, Water, Climates, Temperature, Weather, Albedo.
Identifiers: *Ice caps, Paleoglaciology, Antarctic ice cap, Ice cap surges, Glacier surges.

Surges in ice masses of glacier size are now well accepted in glaciology. There seems no reason why a similar phenomenon should not occur in bodies of ice as large as continental ice sheets. If a continental ice sheet surged into the sea it would have a considerable effect on world sea-level. This is proposed as the mechanism of past sea level fluctuations (cyclothems) of the Carboniferous and Tertiary. The effect of a surge of the Antarctic Ice Sheet on world climate is considered, with particular reference to the origin of ice ages. The requirements of an ice-age mechanism are discussed and it is concluded that a periodic surge of the Antarctic Ice Sheet, perhaps induced by a decrease in insolation to the south polar region, has all the requirements of an ice-age inducing mechanism. In particular, any oscillating system must have capacitance (storage) and impedance (resistance). It is not easy to find a system in nature with a sufficiently long period of oscillation. However, the build up of ice on Antarctica would provide a sufficiently slow charging of storage, and the ice sheet itself would provide the storage to yield a system of long enough period. It is proposed that when the Antarctic Ice Sheet surges, a large ice shelf is produced which increases the albedo of the Earth. The resulting cooling leads to the formation of secondary ice sheets in the Northern Hemisphere, which in turn leads to a further increase in albedo and further cooling. The break up of the ice shelf and its replacement by ocean would lead to a large decrease in the Earth's albedo. The resulting warming would lead to the rapid melting of the subsiduary ice sheets and the ending of the ice age. (Knapp-USGS)
W70-00014

INITIATION OF GLACIER SURGES,
Scott Polar Research Inst., Cambridge (England).
G. De Q. Robin.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 919-928, Aug 1969. 10 p, 6 fig, 11 ref.

Descriptors: *Glaciers, *Flow, *Surges, Movement, Ice, Rheology, Melting, Water, Climates, Temperature, Regimen, Stress, Strain.
Identifiers: Glacier surges.

Three types of instability leading to glacier surges have been suggested, namely stress instabilities, temperature instabilities, and water-film instabilities. Evidence of approximately equal volumes of ice being involved in repeated surges of the same glacier favors stress instabilities as the most likely cause. Since for a steady rate of discharge a section of a glacier undergoing extending flow tends to be of the order of thirty meters thicker than for compressive flow under otherwise similar conditions, it is suggested that surges originate when the glacier flow switches between these two modes of flow. In the accumulation zone of a glacier, a surge would be triggered off by a change from extending to compressive flow over a length of the glacier. If the volume of ice and movement velocities involved are sufficiently large this could lead to repeated surging, although a tendency to stability appears to exist. In the ablation zone, glacier acts as a rigid, sliding dam and increases ice thickness upstream. In this zone, if the volume discharge of the glacier increases beyond a critical limit that depends on bedrock topography, it would initiate a surge. (Knapp-USGS)
W70-00015

WATER LUBRICATION MECHANISM OF GLACIER SURGES,
Northwestern Univ., Evanston, Ill. Dept. of Materials Science; and Army Terrestrial Sciences Center, Hanover, N.H.
J. Weertman.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 929-942, Aug 1969. 14 p, 2 tab, 44 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Floating, Melting, Water, Ice, Movement, Rheology, Temperature, Climates, Regimen, Stress, Strain.
Identifiers: Glacier surges.

A theory of glacier surges is reviewed and amplified. This theory is based on the premise that a glacier surge occurs when a water layer at the base of a glacier attains a thickness sufficient to drown the obstacles in the bed that offer the greatest hindrance to sliding. In the case of a glacier bed which is very smooth, the stress concentrations in the vicinity of obstacles in the bed are so high that the power-law creep equation is no longer valid. As a consequence, the size of the controlled obstacles is reduced and thus a surge is more likely to occur. (Knapp-USGS)
W70-00016

THE ICE-DAM, POWDER-FLOW THEORY OF GLACIER SURGES,
Monsanto Co., St. Louis, Mo.
Lawrence E. Nielsen.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 955-961, Aug 1969. 7 p, 6 fig, 9 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Rheology, Ice, Movement, Stress, Strain, Viscosity, Regimen, Temperature, Stability, Plasticity, Mechanical properties.
Identifiers: *Glacier surges, Powder flow, Ice dams, Stagnant ice.

To explain glacier surges, it is assumed that a stagnant ice block or dam develops in the lower regions of a glacier. Ice gradually builds up above the dam while the dam itself becomes thinner by ablation. Eventually the upper end of the stagnant ice block crumbles from the force of the ice above it, and much of the glacier is changed from a state of compression to one of tension. The breaking of the ice dam results in the glacier rapidly becoming broken into a mass of blocks or powdered ice. The apparent viscosity of the broken-up glacier is much less than that of bulk ice, so high velocities of flow are possible, and a phenomenon similar to a mud flow results. This theory explains why some glaciers repeatedly surge yet appear stagnant between surges. The broken-up appearance of surging glaciers and the delayed surging of tributaries are explained. Additional substantiating observations on several of these phenomena are presented. (Knapp-USGS)
W70-00017

DEFORMATION OF ICE UNDER HIGH INTERNAL SHEAR STRESSES,
McGill Univ, Montreal (Quebec). Dept. of Metallurgical Engineering; and McGill Univ., Montreal (Quebec). Dept. of Geography.
John J. Jonas, and Fritz Muller.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 963-968, Aug 1969. 6 p, 6 fig, 6 ref. Canada Defense Res Board Grant No 9511-73.

Descriptors: *Ice, *Rheology, *Flow, *Stress, Plasticity, Viscosity, Melting, Freezing, Crystal growth, Shear stress, Strain, Mechanical properties.
Identifiers: Ice deformation, Dynamic recrystallization.

By means of transparent plastic dies, cylindrical samples of single crystal and polycrystalline ice were extruded into rods of one quarter the original cross-section area. The deformation was carried out at -5 deg C and a mean strain rate of about .01/s. With the aid of polarized light, the formation of cracks and the occurrence of dynamic recrystallization were studied. The experiments of Steinemann, and more recent results in metals suggest that, during such plastic flow, two types of dynamic recrystallization are involved. At low strain rates, the recrystallization is periodic, leading to rapid increases in strain rate at constant applied stress; at higher strain rates, the recrystallization is continuous and the strain rate is constant. The possibility that dynamic recrystallization of the periodic type is associated with glacier surges is discussed. (Knapp-USGS)
W70-00018

SEMINAR ON THE CAUSES AND MECHANICS OF GLACIER SURGES, ST. HILAIRE, CANADA, SEPTEMBER 10-11, 1968: A SUMMARY,
Geological Survey, Tacoma, Wash.
Mark F. Meier.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 987-989, Aug 1969. 3 p.

Descriptors: *Glaciers, *Flow, *Surges, *Rheology, *Conferences, Reviews, Regimen, Melting, Movement, Ice, Physical properties, Mechanical properties, Plasticity, Viscosity, Climates, Temperature.
Identifiers: *Glacier surges.

A symposium on glacier surges was held in St. Hilaire, Canada, September 1968. As a result of this symposium certain points appear now to be quite well established. Many surging glaciers exist and many types of glaciers surge. However, no surging glaciers which are below freezing at their beds have yet been identified. Surging glaciers occur only in certain limited areas, and these areas apparently are not related to climate, so that some property at the glacier bed must be a necessary condition for a glacier surge. Most, if not all, surging glaciers surge repeatedly and with a period which is reasonably constant. The cause of surges apparently involves drastic changes in bed friction which might be related to water at the bed, either as a thin film or in isolated pockets. However, some very important questions are still outstanding. The temperature regimes in surging glaciers are still unknown. Whether there is a continuous spectrum of behavior from surging glaciers to ordinary 'normal' glaciers, or whether surging glaciers are a class apart, is still an open question. The relation of surging glacier periodicity to mass balance changes or climatic histories cannot yet be defined. The exact role of water at the bed as well as the proper concept of bed roughness have not yet been defined adequately. It was not possible to define glacier surges in a completely satisfactory way, partly because different glaciologists place emphasis on different aspects of this interesting phenomenon. (Knapp-USGS)
W70-00019

GLACIAL ACTIVITY PRECEDING THE 1956 MULDROW GLACIER SURGE IN ALASKA,
Washington Univ., Seattle. Dept. of Electrical Engineering.
A. E. Harrison.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 1001-1007, Aug 1969. 7 p, 7 fig, 6 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Alaska, Surveys, Aerial photography, Climates, Temperature, Melting, Ice, Rheology, Movement, Regimen.
Identifiers: *Glacier surges, Muldrow Glacier (Alaska).

Photographic evidence suggests that a normal wave of ice was progressing down the Muldrow Glacier prior to the occurrence of the surge in 1956. The ice thickening began before 1947, with a wave motion of about 250 m per yr between 1948 and 1952. Progress may have slowed after 1952 because the bulging lateral margin had not reached the McGonagall Pass by 1954. The ice opposite McGonagall Pass thickened spectacularly after 1954 and a lateral ice cliff extended at least 1.6 km beyond McGonagall Pass when the ice began its surge movement in 1956. Aerial photographs taken after the surge ended in 1957, plus photographs from the ground in the vicinity of the bend in the Muldrow before surge motion reached that area in 1956, suggest that several small tributaries were also rejuvenated just before the surge occurred. These observations point to the possibility of climatic synchronism in the Alaskan Range and the southern ranges of North America. (Knapp-USGS)
W70-00020

RECENT OBSERVATIONS ON THE SURGING OTTO GLACIER, ELLESMERE ISLAND,
Defense Research Establishment Ottawa (Ontario). Geophysics Section.
G. Hattersley-Smith.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 883-889, Aug 1969. 7 p, 4 fig, 10 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Surveys, Aerial photography, Movement, Ice, Rheology, Melting, Water, Climates, Temperature, Regimen.
Identifiers: *Ellesmere Island, Glacier surges.

Air photographs show that the Otto Glacier in northwestern Ellesmere Island started to surge sometime between 1950 and 1959, with the result that the terminus advanced about 3 km as a floating ice tongue. Maps prepared from the 1959 photographs and from additional photographs taken in 1964 show a further advance of 2-3 km. Information from a subglacial relief map of the terminal part of the glacier, constructed from the results of radio-depth sounding over the glacier in 1966, may have a bearing on the mechanism of glacier surges. Other glaciers in northern Ellesmere Island show features indicative of past surges. (Knapp-USGS)
W70-00021

WHAT ARE GLACIER SURGES,
Geological Survey, Tacoma, Wash. Water Resources Div.
Mark F. Meier, and Austin Post.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 807-817, Aug 1969. 11 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Glaciers, *Flow, *Surges, Cryology, Ice, Movement, Regimen, Rheology, Surveys, Climates, Temperature, Glacial drift, Sediments.
Identifiers: *Surging glaciers, Glacier surges.

A total of 204 surging glaciers has been identified in western North America. These glaciers surge repeatedly and probably with uniform periods (from about 15 to greater than 100 yr.). Ice flow rates during the active phase may range from about 150 m/yr to more than 6 km/yr, and horizontal displacements may range from less than 1 to more than 11 km. Ice reservoir and ice receiving areas can be defined for surging glaciers, and the reservoir area does not necessarily coincide with the accumulation area. Glaciers, of all shapes, sizes, and longitudinal profiles can surge, and no unusual 'ice dams' or bedrock constrictions are evident. Surges occur in many different climatic, tectonic, and geologic environments, but only certain limited areas (mainly in the Alaska, eastern Wrangell, and St. Elias mountains). Three types of surging glaciers are defined: (1) large to moderate-sized glaciers with large displacements and very fast flow, (2) large to moderate glaciers with moderate displacements and flow rates, and (3) small glaciers with small displacements and moderate to fast flow rates. All three types involve an inherent instability which is self-triggered at regular intervals, but with Type 1 surges an additional (unknown) mechanism produces the very high flow rates. (Knapp-USGS)
W70-00022

CURRENT OBSERVATIONS ON THREE SURGES IN GLACIER BAY, ALASKA, 1965-1968,
American Geographical Society, New York.
William O. Field.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 831-839, Aug 1969. 9 p, 8 fig, 7 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Alaska, Rheology, Ice, Movement, Regimen, Melting, Water, Climates, Temperature.
Identifiers: *Glacier surges, Glacier Bay (Alaska).

Nine glaciers in Glacier Bay, in southeastern Alaska, and three others within a radius of 60 km have been known to surge in the last 60 yr. Of these, seven have surged during the 1960's. The surges of three of them, the Tyeen, Rendu, and Carroll, are discussed in this paper. Each glacier has surged one or more times previously. The course of each surge has been documented by photography but there has been no study of the regimens of these glaciers. The distribution in time and space of these and other surges in the Glacier Bay area are discussed and it is suggested that there may be external factors which cause more surges during some periods than others. These relationships need to be correlated and analyzed. A program of future observations is suggested. (Knapp-USGS)
W70-00023

THE 1978-1980 SURGE OF THE SHERMAN GLACIER, SOUTH-CENTRAL ALASKA,
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
Colin Bull.
Canadian J Earth Sci, Vol 6, No 4 Part 2, p 841-843, Aug 1969. 3 p, 1 fig, 4 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Alaska, Rheology, Ice, Movement, Melting, Regimen, Water, Climate, Temperature.
Identifiers: *Sherman Glacier (Alaska), Glacier surges.

One-third of the ablation area of the Sherman Glacier, Alaska, was covered by a debris sheet resulting from the 1964 Alaskan earthquake. Subsequently observed changes in the mass balance and the movement regime of the glacier lead to the prediction of a surge-type advance in the near future. (Knapp-USGS)
W70-00024

REFERENCES TO GLACIER SURGES IN NORTH AMERICA,
American Geographical Society, New York.
Eva V. Horvath, and William O. Field.
Canadian J Earth Sci, Vol 6, No 4 Part 2, p 845-851, Aug 1969. 7 p, 1 tab, 62 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Bibliographies, *Reviews, Rheology, Ice, Movement, Regimen, Melting, Water, Climates, Temperature.
Identifiers: *Glacier surges, Surging glaciers.

Reported glacial surges in North America are listed and references to surges are compiled. Additional

general discussions of surge phenomena are also listed as well as reports of surges in other parts of the world. (Knapp-USGS)
W70-00025

SURGES OF THE VERNAGTFERNER IN THE OTZTAL ALPS SINCE 1599,
Innsbruck Univ. (Austria).
Herfried C. Hoinkes.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 853-861, Aug 1969. 9 p, 6 fig, 2 tab, 20 ref.

Descriptors: *Glaciers, *Flow, *Surges, Rheology, Ice, Movement, Regimen, Melting, Water, Climates, Temperature.
Identifiers: *Austria, Tyrol, Vernagtferner, Surging glaciers, Glacier surges.

The history of catastrophic advances of Vernagtferner (Otztal Alps, Tyrol) is described briefly. To all appearances these advances were surges. They occurred periodically with a short active advance and a much longer time of retreat; the whole cycle lasted on an average 82 yr. The mode of flow of the ice changed typically; speed during surges increased more than one order of magnitude with heavy crevassing. Dimensions of advance and of retreat were much longer than known from other glaciers in the area. (Knapp-USGS)
W70-00026

EVIDENCE FOR AN ANCIENT GLACIER SURGE IN THE SWISS ALPS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau und Erdbau.
H. Rothlisberger.
Canadian J Earth Sci, Vol 6, No 4 Part 2, p 863-865, Aug 1969. 3 p, 1 fig, 2 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Debris avalanches, Rheology, Ice, Movement, Regimen, Melting, Water, Climates, Temperature, Reviews.
Identifiers: *Switzerland, Alps, Glacier surges.

The climatic and glacial history of two locations in the central Alps has been discussed by Zoller et al. (1966). A brief outline of one aspect of this work is given. In order to explain some peculiar lateral moraines which are only 30-50 m above the valley floor, and a thick layer of presumably glacial deposit down valley, a surge has been postulated, which was triggered by a rock avalanche onto the glacier. (Knapp-USGS)
W70-00027

SOME COMMENTS ON GLACIER SURGES IN EASTERN SVALBARD,
Stockholm Univ. (Sweden). Dept. of Physical Geography.
V. Schytt.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 867-873, Aug 1969. 7 p, 3 fig, 15 ref.

Descriptors: *Glaciers, *Flow, *Surges, Surveys, Regimen, Movement, Ice, Rheology, Melting, Water, Climates, Temperature.
Identifiers: *Spitsbergen, Glacier surges.

Between 1936 and 1938 a great amount of ice flowed out from Sorfonna (the South Ice) on the south coast of Nordaustlandet. What had been an even slope of the ice sheet in 1936 developed into a badly crevassed glacier tongue by 1938, pushing approximately 20 km out to the sea along a front of 30 km. The new glacier was named Brasvellbreen, which in fact means 'rapid growth glacier', but because of World War II, no field investigations could be carried out until more than 10 yr after its discovery. The majority of glaciers in eastern Vestspitsbergen have retreated during this century a few, however, have advanced considerably during short periods and taken part in the general retreat during the rest of the time. Air photographs from 1024, 1938, 1956, and 1957 show that most of the ice edge in western Nordaustlandet has remained stable Sore Franklinbreen, however, has shown large oscillations. The glaciers in the area belong to the sub-polar type, i.e. the 10-m ice temperature in the ablation area remains at about 8-10 deg below zero throughout the yr, whereas the 10-m firn temperature in the accumulation area is at or very near freezing point. There are large variations in accumulation conditions from one Spitsbergen glacier to the other. The west coast of Vestspitsbergen is under the influence of mild and wet air masses from the Atlantic- the east coast is far more continental. The Nordaustlandet ice caps, on the other hand, receive most of their accumulation with winds from the Barents Sea. Annual net balance values of 80-120 g/sq cm are quite common on the eastern slopes of Austfonna (the East Ice), values of 70-90 g/sq cm have been observed along the crest of Sorfonna, and it is likely that large parts of the accumulation area of Brasvellbreen itself receives an annual net balance of between 50 and 90 g/sq cm. (Knapp-USGS)
W70-00028

GLACIER SURGES IN ICELAND, WITH SPECIAL REFERENCE TO THE SURGES OF BRUARJOKULL,
Museum of Natural History, Reykjavik (Iceland). Dept. of Geology and Geography.
Sigurdur Thorarinsson.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 875-882, Aug 1969. 8 p, 8 fig, 1 tab, 7 ref.

Descriptors: *Glaciers, *Flow, *Surges, Movement, Ice, Rheology, Surveys, Melting, Water, Climates, Temperature, Regimen.
Identifiers: *Iceland, Bruarjokull, Glacier surges.

The glacier surges that have occurred in Iceland since 1890 are listed, and the largest ones, those of Bruarjokull in 1890 and 1963-64, are described. The glacier area affected by the surges of Bruarjokull is about 1,400 sq km, the volume of ice and firn affected is about 700 sq km, and the total advance of the glacier front is 8-10 km. The maximum rate of advance of the glacier front in 1963 was at least 5 m/hour. Bruarjokull's surges seem to occur with an interval of 70-100 yr. (Knapp-USGS)
W70-00029

WAS THE GOOD FRIDAY GLACIER ON AXEL HEIBERG ISLAND SURGING,
McGill Univ., Montreal (Quebec).
Fritz Muller.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 891-894, Aug 1969. 4 p, 2 fig, 3 ref.

Descriptors: *Glaciers, *Flow, *Surges, Movement, Ice, Rheology, Melting, Water, Climates, Temperature, Regimen.
Identifiers: *Canada, *Axel Heiberg Island, *Glacier surges.

The lower part of the Good Friday Glacier on Axel Heiberg Island, N.W.T., started, sometime between 1952 and 1959, a period of markedly increased movement associated with a frontal advance of over 2 km, which showed clearly some of the features attributed to a glacier surge, while others were lacking. Such border cases merit special attention. (Knapp-USGS)
W70-00030

GLACIER SURGES IN WEST SPITSBERGEN,
Norsk Polarinstitutt, Oslo.
Olav Liestol.
Canadian J Earth Sci, Vol 6, No 4 Part 2, p 895-897, Aug 1969. 3 p, 2 fig, 2 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Melting, Water, Movement, Ice, Rheology, Climates, Temperature, Regimen.
Identifiers: *West Spitsbergen, Glacier surges.

Surges constitute a common form of glacier advance in Spitsbergen. The fastest movement observed is that of the Negri Clacier, with an advance of about 12 km in less than a yr. Observations on the Finsterwalder Glacier indicate that the ice flow is too small to maintain a steady-state slope. At intervals, of the order of 100 yr, the glacier will balance this build-up by surging. A small surging glacier in the Dickson Valley has a sheet of refrozen meltwater in the front. This refrozen meltwater is possibly generated by the surge. (Knapp-USGS)
W70-00031

EVIDENCE OF SURGES ON THE BARNES ICE CAP, BAFFIN ISLAND,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
O. H. Loken.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 899-901, Aug 1969. 3 p, 1 fig, 2 ref.

Descriptors: *Glaciers, *Flow, *Surges, Movement, Ice, Rheology, Melting, Water, Regimen, Climates, Temperature, Streamflow.
Identifiers: *Canada, *Baffin Island, Glacier surges.

The morphology of the Barnes Ice Cap is studied on the basis of detailed topographic maps. Two anomalous areas characterized by an apparent excess of mass at lower elevations and a similar deficit at higher altitudes are identified. Local surges affecting these two parts of the ice cap could have caused this mass distribution. The moraine patterns adjacent to the ice cap show that the ice margin in the two areas has recently advanced in distinct contrast to the general retreat in adjacent areas. (Knapp-USGS)
W70-00032

PROPAGATION OF GLACIER SURGES,
Scott Polar Research Inst., Cambridge (England); and Cambridge Univ. (England). Cavendish Lab.
G. De Q. Robin, and P. Barnes.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 969-977, Aug 1969. 9 p, 6 fig, 11 ref.

Descriptors: *Glaciers, *Flow, *Surges, Stress, Strain, Plasticity, Viscosity, Melting, Water, Ice, Freezing, Shear stress, Temperature, Mechanical properties, Velocity, Friction.
Identifiers: *Glacier surges, Ice deformation.

Propagation of glacier surges has been discussed in terms of stresses acting in the three major zones of the surge. The steeply sloping front of a surge appears sufficient to explain the thickening of a glacier and the rise in velocity of ice motion which takes place across this zone in terms of accepted stress-strain rate data for ice. Explanation of the high velocities which occur in the next zone in spite of little change in the available shear stress is more difficult, but the experimental results of Barnes and Tabor on ice close to the melting point appear to offer an explanation of the unusually high rates of flow. In the tensile zone, where velocities slow down, the net lowering of the glacier surface after the surge has passed is explained in terms of the depth of crevassing and easier flow of ice at melting point when under tensile and shear stresses. (Knapp-USGS)
W70-00033

A LATE-PLEISTOCENE GLACIAL SEQUENCE FROM PRINCE OF WALES ISLAND, ALASKA,
Forest Service (USDA) Pacific Northwest Forest and Range Experiment Station, Juneau, Alaska.
D. N. Swanston.
Arctic 1969, 22 (1):25-33. 4 fis (1 map), 8 ref.

Descriptors: *Glaciation, *Glacial soils, *Glacial till, *Moraines, Geomorphology, Pleistocene epoch, Alaska.
Identifiers: Glacial geology, Glacial sequences, Regional glaciation, Recessional moraines, Glacial advance, Southeast Alaska.

Evidence of two late-Pleistocene glacial advances is exposed in Maybeso Creek valley. A cemented 'younger' till with a shallow weathered zone directly overlies a thoroughly leached and partly oxidized 'older' till. The younger till was deposited by a glaciation of regional extent representing the last major glacial advance of classical Wisconsin age in southeast Alaska. The older till may also represent a regional glaciation, tentatively correlated with an intermediate to early-late Wisconsin age. Four recessional moraines in the valley record dying pulsations of the glaciation that deposited the younger till during the early part of the late glacial interval preceding the Hypsithermal. (Author)
W70-00166

RAPID HEAT-FLOW SURVEYING OF GEOTHERMAL AREAS, UTILIZING INDIVIDUAL SNOWFALLS AS CALORIMETERS,
Geological Survey, Menlo Park, Calif.
Donald E. White.
J Geophys Res, Vol 74, No 22, p 5191-5201, Oct 15, 1969. 11 p, 7 fig, 1 tab, 12 ref.

Descriptors: *Geothermal studies, *Heat flow, *Snowfall, *Surveys, Springs, Thermal water, Thermal radiation, Winds, Air temperature, Mapping, Contours, Computers, Infrared radiation.
Identifiers: *Yellowstone Park (Wyo), Heat-flow survey.

Individual heavy snowfalls were utilized for a rapid low-cost means of measuring the total heat flows in hot spring areas of Yellowstone Park, Wyoming. The method consists of mapping on a suitable base the contacts between snow-covered and snow-free ground after a favorable snowfall (heavy snow, brief duration, air temperature near 0 deg C). Each mapped contact as time elapses after a specific snowfall, is a heat flow contour representing a decreasing rate of flow. Heat flow contacts mapped to date vary from 450 to 5500 micro cal/sq cm sec, or 300 to 3700 times the world average of conductive heat flow. Thermal anomalies from infrared imagery are similar in shape to heat-flow contours of a test area near Old Faithful Geyser of the Yellowstone Park. (Gabriel-USGS)
W70-00201

A CONTRIBUTION TO THE THEORY OF GLACIER SURGES (IN FRENCH),
Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie.
Louis A. Lliboutry.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 943-953, Aug 1969. 11 p, 5 fig, 1 tab, 17 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Friction, Movement, Ice, Rheology, Stress, Strain, Viscosity, Melting, Water, Regimen, Climates, Temperature.
Identifiers: Glacier surges.

Glacier surges may result (1) from the warming of a cold glacier, which follows an unusual snow cover, with the formation of a temperature basal layer, or (2) from the fact that two values of the sliding velocity correspond to a single value of the friction. As a rule, for increasing sliding velocities the friction goes through a maximum and next through a minimum. Thus for one value of the friction three values of the velocity, two stable ones and an unstable one, can exist. Since the derivative of the friction with respect to the sliding velocity may become negative, the coefficients in the perturbation equation may become infinite (their ratio remaining finite), and next negative. When a flood wave runs down a glacier, an area with a negative diffusion coefficient may appear. Then the profile of the wave is altered; it vanishes at the upper part of this area and swells beyond measure at the lower one. Factors which may limit the amplitude of this surge are pointed out. (Knapp-USGS)
W70-00221

GLACIER SURGES IN THE KARAKORAM HIMALAYA (CENTRAL ASIA),
Toronto Univ. (Ontario). Dept. of Geography.
Kenneth Hewitt.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 1009-1018, Aug 1969. 10 p, 2 fig, 1 tab, 71 ref.

Descriptors: *Glaciers, *Flow, *Surges, *Reviews, *Bibliographies, Alaska, Movement, Ice, Rheology, Temperature, Mountains, Climates, Melting, Water, Freezing.
Identifiers: *Karakoram, Yukon, Glacier surges.

The Karakoram and Alaska-Yukon region between them account for perhaps 90% of the known surging glacier events. While modern research and information is available for North America, the Karakoram, though often referred to, remains virtually unknown except in a very general sense. The prime aim of this paper is to collate all the information that is available for the Karakoram from the usually old and inaccessible documents where it is found. It establishes eleven instances of surges with reasonable certainty and the probability of many more. The rare instances of detailed description of the phenomena are quoted. A short discussion is given of the degree to which the information, and knowledge of the Karakoram environment, equate with various mechanisms put forward to explain surging glacier events. (Knapp-USGS)
W70-00222

DISTRIBUTION OF SURGING GLACIERS IN WESTERN NORTH AMERICA,
Geological Survey, Tacoma, Wash.
Austin Post.
J Glaciol, Vol 8, No 53, p 229-240, 1969. 12 p, 5 fig, 1 tab, 13 ref.

Descriptors: *Glaciers, *Surges, *Regimen, *Alaska, *Surveys, Climates, Cryology, Ice, Mountains, Rheology, Frequency, Precipitation (Atmospheric), Flow, Friction, Heat flow.
Identifiers: *Surging glaciers, Glacial surges.

In western North America 204 surging glaciers have been identified by aerial photographic observations. These glaciers exhibit intense crevassing and rapid ice displacements during surges, or distinctive surface features which have resulted from past surges. Distribution of these unusual glaciers is not random throughout the glacierized areas, as they occur only in the Alaska Range, eastern Wrangell Mountains, eastern Chugach Mountains, Icefield Ranges, and the St. Elias Mountains near Yakutat and Glacier Bay. No surging glaciers have been identified in the Brooks Range, Kenai Mountains, west and central Chugach Mountains, west and central Wrangell Mountains, Coast Mountains, Rocky Mountains, Cascade Range, Olympic Mountains, or Sierra Nevada. No definite reason for this restricted distribution is apparent. Surging glaciers are found in maritime to continental and temperate to subpolar environments. Practically all physical forms of glaciers are represented. The restricted distribution does not relate to topography, bedrock type, altitude, orientation, or size of glacier. Some surging glaciers are associated with fault-related valleys, but neither recent faulting nor earthquakes have initiated surge activity. Possible causes for the limited distribution of surges are unusual bedrock roughness or permeability in certain areas, anomalously high groundwater temperatures, and abnormal geothermal heat flow. (Knapp-USGS)
W70-00239

HEAT BUDGET OF AN ICE COVERED INLAND LAKE,
Wisconsin Univ., Madison.
John T. Scott, and Robert A. Ragotzkie.
ONR Contract 1202 (07). Task NR 387-022. Technical Report No 6, Department of Meteorology, University of Wisconsin, Oct, 1961. 5 p, 13 tab, 15 fig, 23 ref, 7 append.

Descriptors: *Heat budget, *Radiation, *Latent heat, *Advection, Conduction, Snow cover.
Identifiers: Heat storage, Lake Mendota.

The heat budget for Lake Mendota is evaluated for two winter seasons. Change in heat storage, radiation flux conduction and advection are determined separately for snow, ice and water where applicable. The general heat budget equation Rn= C+ E+ L is used where Rn is net radiation, C is change in heat storage and L is exchange of sensible heat between the surface and the air. It is observed that net radiation, air temperature and snow cover are the most important factors affecting the heat budget equation. With some improvement in the methods, the heat budget can be used as a check against instrumental techniques for determining sensible heat flux (L) because during winter, evaporation is often negligible for long cold periods. Seven distinct periods of the winter season are described using the heat budget data for the two years. (Upadhyaya-Vanderbilt)
W70-00317

2D. Evaporation and Transpiration

PREDICTION OF SOIL AND WATER LOSSES,
Agricultural Research Service, Tifton, Ga. Soil and Water Conservation Research Div.; and Agricultural Research Service, Athens, Ga. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02A.
W70-00066

CONVECTIVE CIRCULATION IN WATER INDUCED BY EVAPORATIVE COOLING,
National Bureau of Standards, Washington, D.C.
W. G. Spangenberg, and W. R. Rowland.
The Physics of Fluids, Vol 4, No 6, p 743-750, June 1961. 10 fig, 9 ref.

Descriptors: *Convection circulations, *Convection currents, Thermal pollution, Cooling water, Evaporation.
Identifiers: *Schlieren photographs, Fluid depth effects, Temperature distribution, Columnar plunging, Surface deformation.

Schlieren photographs taken simultaneously from the top and side of a tank of water are here used to study convection currents induced by evaporative cooling. It is found that water from the cooled surface layer collects along lines producing thickened regions which become unstable and plunge in vertical sheets. Surface water then continues to flow downward through the sheets, reducing the cooled surface layer to a thin film. In top schlieren views the plunging regions sometimes appear straight, sometimes curved, and branched or terminated with no fixed pattern. The number of lines per unit area is a function of the cooling rate rather than the depth of the container. Reticulated surface patterns were observed only at particular cooling rates and columnar plunging occurred only on rare occasions. No distinctly different combination of conditions to differentiate between the causes of these different modes was evident. Numerical integration of the nonlinear temperature distribution in the cooled layer showed a critical Rayleigh number of 1193 when convective circulation started, and a Rayleigh number of 102 for maintaining an established uniform circulation. (Ross-Vanderbilt)
W70-00156

2E. Streamflow and Runoff

MISSISSIPPI RIVER FLOOD PLAIN INFORMATION, ROCK ISLAND COUNTY, ILLINOIS AND SCOTT AND MUSCATINE COUNTIES, IOWA.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W70-00001

ROCK RIVER FLOOD PLAIN INFORMATION, ROCK ISLAND COUNTY, ILLINOIS.
Corps of Engineers, Rock Island, Ill.
For primary bibliographic entry see Field 04A.
W70-00004

FLOOD PLAIN INFORMATION, WOLF RIVER FROM LAKE POYGAN TO SHAWANO, WISCONSIN.
Corps of Engineers, Chicago, Ill.
For primary bibliographic entry see Field 04A.
W70-00008

FLOOD PLAIN INFORMATION, FRENCH AND CUSSEWAGO CREEKS, MEADVILLE, PENNSYLVANIA.
Corps of Engineers, Pittsburgh, Pa.
For primary bibliographic entry see Field 04A.
W70-00010

THE MEASUREMENT OF HIGH DISCHARGES IN TURBULENT RIVERS USING TRITIUM TRACER,
International Atomic Energy Agency, Vienna (Austria); and Ministry of Natural Resources, Nairobi (Kenya). Dept. of Water Development.
For primary bibliographic entry see Field 07B.
W70-00035

DETERMINATION OF THE OPTIMUM STORAGE CAPACITY OF RESERVOIRS AND THE ASSOCIATED PROBABILITIES,
Ministry of Irrigation and Power, New Delhi (India).
K. C. Majumdar.
J Hydrol, Vol 8, No 3, p 303-322, Jul 1969. 20 p, 1 fig, 5 tab, 9 ref.

Descriptors: *Reservoir operation, *Streamflow forecasting, *Probability, Irrigation, Hydroelectric power, Water storage, Water management (Applied), Planning, Reservoir design, Computer programs, Statistical methods.
Identifiers: *India.

A method has been developed to determine the optimum storage capacity of a reservoir corresponding to different probabilities of the desired amount of water each year. The method considers a large number of random normal deviates to represent a simulated series of annual inflow data. For the purpose of determination of storage capacity of any dam, the probabilities of the reservoir fullness of emptiness were determined for different values of draft and storage capacities. These have been obtained by drawing 5152 simulated data and analyzing them in an IBM 1620 electronic computer. The results presented can be applied to any river basin of which annual runoffs obey the normal distribution law. A method of economically fixing the optimum storage capacity by taking into consideration the expected net return from the project is also indicated. (Knapp-USGS)
W70-00038

ON THE DISTRIBUTION OF THE FREQUENCY OF RESERVOIR DEFICIT,
City Univ., London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W70-00041

FLOOD PLAIN INFORMATION, WESTFIELD AND LITTLE RIVERS, WESTFIELD, MASSACHUSETTS.
Corps of Engineers, Waltham, Mass.
For primary bibliographic entry see Field 04A.
W70-00042

MAGNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES: PART 2. PACIFIC SLOPE BASINS IN CALIFORNIA - KLAMATH AND SMITH RIVER BASINS AND CENTRAL VALLEY DRAINAGE FROM THE EAST,
Geological Survey, Washington, D.C.
L. E. Young, and R. W. Cruff.
Geol Surv Water-Supply Pap 1686, 1967. 308 p, 20 fig, 2 plate, 4 tab, 13 ref.

Descriptors: *Flood forecasting, *California, *Rainfall-runoff relationships, Streamflow forecasting, Routing, Stage-discharge relations, Topography, Water storage.
Identifiers: Flood frequency, Klamath River Basin (Calif), Smith River Basin, Central Valley.

A method is presented for determining the probable magnitude of annual maximum floodflows for any recurrence interval between 1.2 and 50 years for any stream, gaged or ungaged, in and near the Klamath and Smith River basins, California. The area has been divided into 4 regions of differing flood-frequency characteristics. The flood-frequency relat ion is undefined in one of these regions - the flat Central Valley because of the lack of records for unregulated streams within its boundaries. The hydrologic basin characteristics having the most significant effect on the flood magnitude were drainage area, mean annual precipitation, slope, and altitude. These were used as independent variables to derive equations for determining flood magnitudes for recurrence of 1.2, 2.33, 5, 10, 25, and 50 yr. From these equations, flood magnitude-frequency relations can be constructed. The procedure for computing flood magnitude is not applicable at sites where the drainage area is less than 10 sq mi or where the usable storage exceeds 4.5 million cu ft (103 acre-ft) per sq mi. (Knapp-USGS)
W70-00052

THE MECHANICS OF SURFACE RUNOFF,
Florida Univ., Gainesville. Dept. of Bioenvironmental Engineering.
John C. Schaake, Jr.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 105-116, 1967. 12 p, 5 fig, 1 tab, 12 ref.

Descriptors: *Runoff forecasting, *Mathematical models, *Digital computers, *Synthetic hydrology, Rainfall-runoff relationships, Routing, Unit hydrographs, Hydrograph analysis, Overland flow, Channel flow.
Identifiers: Drainage basin model.

The new digital computers with micro-second cycle times and core storage in excess of 30,000 words have made it practical to synthesize the surface runoff process by mathematical models. This synthesis involves simulating overland flow and flow in open channels and routing these flows through the watershed. The basic equations for the flow of flood waters in open channels and the basic equations for the overland flow of surface runoff have long been known to be the same, and they have been used by many investigators to route flood waves in rivers and to examine properties of overland flow hydrographs. Analytic solutions of these basic partial differential equations exist only for a few special cases of practical interest. In general, numerical solutions by finite difference methods are necessary. It is feasible and practical to synthesize the surface runoff process for small impervious watersheds. Runoff measurements are not needed so the procedure applies to ungaged areas. Friction coefficients must be estimated, but the computed hydrograph is not very sensitive to uncertainty in these coefficients. The mathematical model should be useful for studying the effects of the aerial variability of rainfall, for obtaining synthetic unit hydrographs for studying watershed linearity, and to provide data to test instrumentation designs for small watersheds. (Knapp-USGS)
W70-00055

SOME EFFECTS OF URBANIZATION ON RUNOFF AS EVALUATED BY THORNTHWAITE WATER BALANCE MODELS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Geography.
For primary bibliographic entry see Field 04C.
W70-00057

HYDROLOGY OF SMALL DRAINAGE BASINS FOR DEVELOPING HYDRAULIC DESIGN CRITERIA,
South Dakota State Univ., Brookings.
William F. Lytle, and Shu-Tung Chu.
South Dakota Water Resources Institute, Research Project Technical Completion Report, September 1, 1969. 166 p, 5 ref, 7 append. OWRR Proj No A-012-SDAK.

Descriptors: Hydrograph, Hydrologic models, Runoff, *Surface runoff, *Unit hydrograph, *Watershed studies.

A study was made of nine South Dakota watersheds varying in size from two square miles up to 750 square miles to determine the usefulness of the parameter, 'The Time Base of the Instantaneous Unit Hydrograph.' This parameter was calculated from 100 storm runoff periods with no reference to the rainfall or 'rainfall excess' that was associated with the storm. A correlation analysis was run with the 'Time Base' and the physical measurements of the watershed. (Author)
W70-00137

EFFECTS OF WATER TEMPERATURE ON BED-LOAD MOVEMENT,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W70-00142

DISPERSIVITY TENSOR FOR TURBULENT UNIFORM CHANNEL FLOW,
Hydronautics, Inc., Laurel, Md.
For primary bibliographic entry see Field 08B.
W70-00210

NONDIMENSIONAL GRADUALLY-VARIED FLOW PROFILES,
Illinois Univ., Urbana. Dept. of Civil Engineering.
Cheng-lung Chen, and Chun-Tsung Wang.
ASCE Proc, J Hydraul Div, Vol 95, No HY5, Pap 6790, p 1671-1686, Sept 1969. 16 p, 10 fig, 11 ref, append.

Descriptors: *Open channel flow, *Unsteady flow, *Flow profiles, *Hydraulic jump, Supercritical flow, Turbulent flow, Hydraulics, Chezy equation, Mannings equation, Regime.
Identifiers: Gradually varied flow.

Chezy's and Manning's flow formulas are used to formulate flow equations for gradually-varied flow in wide rectangular channels. The flow equations are normalized by critical depth and critical slope, so that a parameter governing the flow is evident. This parameter is called normal-flow Froude number for flow on sustaining (mild, critical, and steep) slopes, and conceptual normal-flow Froude number for flow on adverse slopes. No third parameter governs flow on the horizontal slope. Critical depth, critical slope, and the normal-flow Froude number can be systematically found from nomographs for flow of a given discharge per unit width in a wide channel of given channel slope and roughness. Hydraulic-jump equations can also be normalized with the same normalizing quantities used in flow equations. Solutions of normalized flow and hydraulic-jump equations are graphically expressed, permitting direct use. (Knapp-USGS)
W70-00216

FLOOD WAVE MODIFICATION ALONG PRISMATIC CHANNELS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-00218

INVESTIGATION OF BRAHMAPUTRA RIVER,
East Pakistan Water and Power Development Authority, Dacca. Water Investigation.
Abdul Latif.

ASCE Proc, J Hydraul Div, Vol 95, No HY5, Pap 6793, p 1687-1698, Sept 1969. 12 p, 7 fig, 4 tab, 4 ref.

Descriptors: *Flood control, *International waters, Rivers, Stream erosion, Dikes, Levees, Runoff, Streamflow, Surveys, River basin development, Water resources development, Water management (Applied).
Identifiers: *Brahmaputra River (India-Pakistan).

The Brahmaputra River, one of the largest rivers of the world, is international in character, originating in Tibet and flowing through India before reaching East Pakistan, and control of flooding from this river ia a major problem. The problem has been considered by several experts who have expressed the opinion that flood protection must be provided by river embankment. The Brahmaputra right bank embankment and the proposed left bank embankment are described. For the study of river regime and for developing design criteria for the flood control projects, detailed hydrographical and hydrological surveys of the river have been in progress since 1964. (Knapp-USGS)
W70-00219

ONE-DIMENSIONAL ANALYSIS OF FLOODS AND TIDES IN OPEN CHANNELS,
Tippetts-Abbett-McCarthy-Stratton, New York.
Armando Balloffet.
ASCE Proc, J Hydraul Div, Vol 95, No HY4, Pap 6695, p 1429-1451, July 1969. 23 p, 14 fig, 2 tab, 6 ref, append.

Descriptors: *Flood forecasting, *Synthetic hydrology, *Mathematical models, Hydraulics, Floods, Hydrograph analysis, Tides, Unsteady flow, Deltas.
Identifiers: Orinoco River (Venezuela), Sinu River (Colombia).

The one-dimensional equations of gradually varied, unsteady flow in open channels are integrated to obtain stages and discharges along a river subject to tides and floods. An explicit procedure of finite differences is used, considering branches, independent tributaries (pumps), contractions due to bridges or barriers, with or without tidal gates, and flood plains restricted or not by levees. The boundary conditions may be represented by: tides at both ends; tides at one end and discharge at the other; surge or stage hydrographs at any station; and combinations of the previous conditions. Three examples are presented covering a wide range of conditions. (Knapp-USGS)
W70-00226

FLOW RETARDANCE IN VEGETATED CHANNELS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-00228

TIDAL MODEL OF NORTHUMBERLAND STRAIT,
Acres (H. G.) and Co. Ltd., Niagara Falls (Ontario).
For primary bibliographic entry see Field 02L.
W70-00231

SPREAD OF BUOYANT JETS AT THE FREE SURFACE,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil ENGINEERING.
For primary bibliographic entry see Field 08B.
W70-00232

GENERATING SYNTHETIC STREAM-FLOW RECORDS FOR NEW ZEALAND RIVERS,
Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering.
W. C. Boughton, and A. McKerchar.
J Hydrol, New Zeal, Vol 7, No 2, p 112-123, 1968. 12 p, 3 fig, 2 tab, 14 ref, 1 append.

Descriptors: *Simulation analysis, *Synthetic hydrology, *Streamflow forecasting, *Rainfall-runoff relationships, Mathematical models, Hydrologic data, Statistical methods, Computer programs, Probability, Sampling, Hydrograph analysis, Regression analysis.
Identifiers: *New Zealand, Thomas-Fiering models.

The Thomas-Fiering model for generation of synthetic streamflow records has been used with data from some New Zealand catchments. Available records are sparse and only 4 gaging stations have records of more than 20 years. Possible errors which can occur when short records are used to estimate monthly means, serial correlations, etc., are demonstrated. A simple simulation model for testing the difference between historic and synthetic records in determining reservoir size is described. A digital computer program listing for the simulation model is included. (Knapp-USGS)
W70-00251

OBSERVED LARGE-SCALE STRUCTURE OF TURBULENCE IN A RIVER MOUTH,
For primary bibliographic entry see Field 02L.
W70-00253

GEOMORPHIC EFFECTS OF FLOODS IN THE ORERE RIVER CATCHMENT, EASTERN HUNUA RANGES,
Auckland Univ. (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 02J.
W70-00254

GENERATION OF MONTHLY STREAM-FLOW DATA,
Ministry of Works, Wellington (New Zealand). Civil Div.
F. H. Pearson.
J Hydrol, New Zeal, Vol 7, No 2, p 101-111, 1968. 11 p, 2 fig, 11 ref, 1 append.

Descriptors: *Synthetic hydrology, *Hydrograph analysis, *Streamflow forecasting, *Rainfall-runoff relationships, Mathematical models, Hydrologic data, Statistical methods, Computer programs, Simulation analysis, Probability, Sampling.
Identifiers: *New Zealand.

Usually the length of a streamflow record is insufficient to contain extreme values and critical sequences required for the design of water-resource system components. Data are sometimes required for an ungaged stream. The Thomas-Fiering model may be used for the generation of a synthetic record of mean monthly streamflow of any required length. Data may be obtained by analysis of a shorter observed record for the stream, by analysis of regional characteristics of streamflow, or by analysis of the rainfall excess and consideration of storage in the catchment. Different considerations apply to the generation of synthetic flows for low-flow studies than for other types of problems. The extent to which the characteristics of an observed flow record will be reproduced in a synthetic record generated from the observed record is discussed. (Knapp-USGS)
W70-00255

A MATHEMATICAL CATCHMENT MODEL FOR ESTIMATING RUNOFF,
Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02A.
W70-00257

HORIZONTAL TWO-DIMENSIONAL DENSITY CURRENT,
New South Wales Univ., Kensington (Australia).
For primary bibliographic entry see Field 08B.
W70-00319

FLOOD ROUTING WITH VARIABLE TRAVEL TIME OR VARIABLE STORAGE COEFFICIENTS,
Agricultural Research Service, Bushland, Tex.
Jimmy R. Williams.
Trans Amer Soc Agr Eng, Vol 12, No 1, p 100-103, Jan-Feb 1969. 4 p, 7 fig, 3 tab, 7 ref.

Descriptors: *Flood routing, Hydrology, Storage coefficient, Outflows, Hydrographs, Inflow, Floods, Computer programming, *Flood hydrographs, Methodology.
Identifiers: Variables, *Travel time, Variation coefficients, *Flood hydrology, Brushy Creek (Tex).

The variable travel-time method and the variable storage-coefficient method for flood routing are described. These methods maintain the runoff volume without gain or loss during the routing computation. Although based on previous work, the methods include refinements that improve the accuracy of predicting flood-wave movement. The basis for the methods is the universal law of storage; that is, for a given time interval, the change in storage in a given reach is equal to the volume of inflow minus the volume of outflow. Because the methods preserve the correct volume, they will fill a need long felt. Both procedures are logical and adaptable to most flood routing problems. Good results were obtained when the methods were used on the Brushy Creek watershed in Texas. (USBR)
W70-00344

A NEW METHOD OF INVESTIGATING RIVER RECESSION CURVES,
Raikes and Partners, Rome (Italy).
T. R. E. Chidley.
J Inst Water Eng, Vol 23, No 3, p 177-186, May 1969. 12 p, 8 fig, 8 tab, 3 ref.

Descriptors: *Rivers, *River forecasting, River regulation, Hydrology, *Recession curves, Hydrographs, Hydrologic data, Discharge (Water), Runoff, Surface runoff, Methodology, *Streamflow forecasting, Rainfall.
Identifiers: Usk River, Great Britain.

A method of analyzing and forecasting river recession curves soon (3 days) after cessation of rain is presented. The principle underlying the method is to isolate the recession rate rather than the actual recession and then to relate this to parameters known to affect the recession rate. In this case, river discharge (implicitly a measure of groundwater levels), antecedent conditions, and season were used; other more objective parameters could be used. The basis for the method is numerical, and any recession curve can be analyzed automatically from a set of rainfall and runoff data by either computer or manual methods. All subjectivity has been removed from the analysis except in the choice of parameters believed to affect the recession rate. The method can be used as a subroutine for simulation of runoff data from rainfall records when a river is receding. (USBR)
W70-00353

FLOOD PREVENTION.
For primary bibliographic entry see Field 04A.
W70-00405

2F. Groundwater

RECONNAISSANCE OF GEOLOGY AND OF GROUNDWATER OCCURRENCE IN WHITMAN COUNTY, WASHINGTON,
Geological Survey, Tacoma, Wash.
Kenneth L. Walters, and P. A. Glancy.
Wash Dep Water Resources Water Supply Bull No 26, 1969. 169 p, 8 fig, 4 plate, 5 tab, 19 ref, append.

Descriptors: *Water resources, *Groundwater, *Washington, Water wells, Aquifers, Hydrographs, Water levels, Water level fluctuations, Water yield, Water utilization, Irrigation water, Municipal

water, Water quality, Hydrogeology, Hydrologic data, Data collections.
Identifiers: Whitman County (Wash).

Whitman County covers about 2,200 sq. mi in southeastern Washington, adjacent to the Washington-Idaho boundary. Average annual precipitation in the county ranges from about 14 to 20 inches. Agriculture is the principal industry--chiefly dryland wheat farming, although some pasture and hay crops are irrigated. Much of the county is underlain by a thick sequence of basalt flows mantled by loess. Locally, older nonbasaltic crystalline rocks are exposed, principally in the eastern part of the county. The yield of large-diameter wells that penetrate several hundred feet of basalt in Whitman County is about 125 to 200 gpm for every 100 ft of saturated basalt penetrated. Adequate yields of water for domestic and stock supplies are commonly obtained from loess or from the contact between the loess and the underlying basalt. Pleistocene gravel deposits and Recent alluvium characteristically yield little water. Locally, however, yields of several hundred gpm are obtained from wells that penetrate the gravel, or the alluvium in the Snake River valley. Hydrographs of wells in the Pullman area indicate a continuing decline in water level. (Knapp-USGS)
W70-00012

FACTORS AFFECTING INFILTRATION AND RECHARGE IN A LOESS COVERED BASIN,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 02G.
W70-00036

INTERPRETATION OF FLUCTUATIONS IN A CARBONIFEROUS LIMESTONE AQUIFER AT MOUSCRON, BELGIUM (FRENCH),
Geologic Service of Belgium.
M. Gulinck.
Bull Int Ass Sci Hydrol, Vol 14, No 1, p 129-144, Mar 1969. 16 p, 13 fig.

Descriptors: *Aquifers, *Limestones, *Water level fluctuations, Hydrologic data, Pumping, Water wells, Water storage, Industrial plants, Water supply, Mathematical studies, Transmissivity, Theis equation, Seasonal, Permeability, Porosity, Karst, Compressibility, Mapping, Discharge (Water).
Identifiers: *Belgium, *Mouscron.

Pumping data recorded during the months of July and August 1956 at a pumping water well of 170 m in depth and drawing water from a Carboniferous limestone of the Mouscron, Belgium area, were analytically investigated on the basis of the simplified Theis-Jacob formula and certain mathematical assumptions. The confined aquifer of the limestone zone of the Roubais-Fourcoing-Mouscron area can be well analyzed by using the classic formulas of underground hydrology. The coefficients of transmissivity and water storage equal to 0.000275 sq m and 0.000103, respectively, computed analytically can be assumed to be acceptable as the mean hydrologic characteristics of the limestone aquifer. Some additional characteristics of the limestone aquifer can be deduced. (Gabriel-USGS)
W70-00040

RAPID HEAT-FLOW SURVEYING OF GEOTHERMAL AREAS, UTILIZING INDIVIDUAL SNOWFALLS AS CALORIMETERS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02C.
W70-00201

THE GROUNDWATER SITUATION IN OHIO,
Geological Survey, Columbus, Ohio. Water Resources Div.
Stanley E. Norris.
Ground Water, Vol 7, No 5, p 25-33, Sept-Oct 1969. 9 p, 6 fig, 5 ref.

Descriptors: *Groundwater, *Water resources, *Ohio, Surveys, Hydrologic budget, Water sources, Aquifers, Glacial drift, Limestones, Snadstones, Water storage, Water pollution, Injection wells.
Identifiers: Groundwater resources (Ohio).

Present groundwater use in Ohio, approximately 650 mgd, amounts to about 5% of the water that enters the groundwater reservoirs. The largest groundwater supplies are developed where natural concentrations of water occur, chiefly in the watercourse aquifers, which consist of sand and gravel of glacial origin (outwash) in the valleys of the major streams. Other important aquifers are glacial outwash in upland areas and in the buried Teays Valley system, the limestone and dolomite aquifers in western Ohio, and sandstone and shale aquifers in the eastern half of the State. Future outlook is that more of the increasing water demand will be met from groundwater sources. Groundwater supplies will be developed at many new sites, and aquifers in areas already heavily pumped will be made to yield more water by the drilling of additional wells and recharging the aquifers artificially. Large quantities of groundwater in storage, virtually unexploited, could be used for temporary low-flow augmentation of streams. Management of groundwater resources will be needed to help solve supply and distribution problems, and to resolve conflicts between users. Among future problems will be those arising from underground disposal of wastes, a practice which is expected to grow substantially from enforcement of water-quality standards for streams, set under the Federal Water Quality Act of 1965. (Knapp-USGS)
W70-00203

ANALOG-DIGITAL MODELS OF STREAM-AQUIFER SYSTEMS,
Geological Survey, Denver, Colo.
E. A. Moulder, and C. T. Jenkins.
Ground Water, Vol 7, No 5, p 19-24, Sept-Oct 1969. 6 p, 8 fig, 3 ref.

Descriptors: *Computer models, *Analog models, *Digital computers, *Surface-groundwater relationships, Conjunctive use, Model studies, Simulation analysis, Optimization, Water management (Applied), Streams, Aquifers, Water demand, Water rights.
Identifiers: Hybrid computer models.

The best features of analog and digital computers were combined to make a management model of a stream-aquifer system. The analog model provides a means for synthesizing, verifying, and summarizing aquifer properties; the digital model permits rapid calculation of the effects of water-management practices. Given specific management alternatives, a digital program can be written that will optimize operation plans of stream-aquifer systems. The techniques are demonstrated by application to a study of the Arkansas River valley in southeastern Colorado. (Knapp-USGS)
W70-00204

GROUNDWATER STUDIES--CHICAGOLAND DEEP TUNNEL SYSTEM,
Harza Engineering Co., Chicago, Ill. Water Resources Planning Div.; and Metropolitan Sanitary District of Greater Chicago.
For primary bibliographic entry see Field 05G.
W70-00205

GROUNDWATER GEOLOGY OF ALLUVIAL FAN AQUIFERS LOCATED IN THE WESTERN THIRD OF THE GWYDIR RIVER VALLEY, NEW SOUTH WALES, AUSTRALIA,
Northern Illinois Univ., DeKalb. Dept. of Geology.
For primary bibliographic entry see Field 04B.
W70-00207

AN APPLICATION OF SURFACE GEOPHYSICAL TECHNIQUES TO THE STUDY OF WATERSHED HYDROLOGY,
Geological Survey, Helena, Mont.; and Pennsylvania State Univ., University Park. School of Forest Resources.
Ronald R. Shields, and William E. Sopper.
Study supported by OWRR-Dept of Interior, and McIntire-Stennis Coop Forestry Res Program. Water Resources Bull, Vol 5, No 3, p 37-49, Sept 1969. 13 p, 6 fig, 2 tab, 16 ref. OWRR Project A-006-PENN.

Descriptors: *Hydrogeology, *Surveys, *Geophysics, *Seismic studies, *Electrical studies, Aquifers, Water table, Water management (Applied), Subsurface mapping, Small watersheds, Water storage, Springs, Streams.
Identifiers: Groundwater prospecting (Geophysical).

The applicability of geophysical methods to experimental watershed research is demonstrated by a study of a 106-acre forested watershed in central Pennsylvania. Data from a shallow seismic refraction study and an electrical resistivity study of the watershed were used to determine the depth of soils, their volumes, depth to bedrock, configuration of the bedrock surface and delineation of the bedrock surface and of the water table. With this information on the subsurface conditions, the hydrologic properties of the watershed were described in greater detail. This information is of value in explaining the watershed's response to various watershed treatment practices that eventually will be used. (Knapp-USGS)
W70-00209

SALTWATER INTRUSION IN THE UNITED STATES.

Rep prepared by Task Committee on Saltwater Intrusion of Comm on Groundwater Hydrol of the Hydraul Div, ASCE. ASCE Proc, J Hydraul Div, Vol 95, No HY5, Pap 6788, p 1651-1669, Sept 1969. 19 p, 1 tab, 7 ref.

Descriptors: *Saline water intrusion, *Groundwater movement, *Groundwater, Aquifers, Coasts, Pumping, Recharge, Sea water, Seepage, Water levels, Water pollution sources, Water pollution control.
Identifiers: Saline groundwater.

The occurrence of saline groundwater in the U. S. is described in terms of geologic and hydrologic conditions. Three general mechanisms of intrusion are considered. The extent of salt water intrusion is given using a detailed listing of examples from throughout the United States. Statements are included regarding some of the areas where major control efforts are underway. (Knapp-USGS)
W70-00211

NATURAL RESOURCES OF UNDERGROUND WATERS CONFINED TO THE ZONE OF FREE WATER EXCHANGE OF THE IRKUTSK AMPHITHEATER (RUSSIAN),
Hydrogeological Station, Irkutsk (USSR).
V. A. Maliy.
Sovetskaya Geologiya, SSSR, Issue No 4, p 144-151, Apr 1969. 8 p, 5 fig, 1 tab, 11 ref.

Descriptors: *Subsurface runoff, *Water resources, *Groundwater basins, *Groundwater movement, *Base flow, Discharge (Water), Drainage water, Ice, Seasonal, Evaporation, Streamflow, Hydrogeology, Bogs, Hydrographs, River basins, Water loss, Watersheds (Basins), Wetting, Precipitation (Atmospheric).
Identifiers: *USSR, Irkutsk region.

Underground runoff of the Irkutsk amphitheater was investigated on the basis of geological and hydrogeological data recorded at 49 gaging stations located at several rivers and streams of the area. The whole area can be subdivided into 3 basin

groups characterized by their coefficients of underground runoff (underground runoff-precipitation ratio), by their coefficients of underground feeding of rivers, and general drainage, precipitation and wetting. Within the limits of each group the underground runoff reveals close association with precipitation, general runoff and general wetting. The association of the coefficients of underground runoff with the parameters is not clear-cut; however, it is still well identified. (Gabriel-USGS)
W70-00233

CALCULATIONS PERTAINING TO THE DESALINATION OF SALT-CONTAINING FORMATIONS UNDERLAIN BY AN AQUIFER OF GOOD PERMEABILITY (RUSSIAN),
Sredneaziatskii Nauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
For primary bibliographic entry see Field 03A.
W70-00243

COMPACTION AND MIGRATION OF FLUIDS IN MIOCENE MUDSTONE, NAGAOKA PLAIN, JAPAN,
Japan Petroleum Development Corp., Tokyo.
Kinji Magara.
Amer Ass Petrol Geol Bull, Vol 52, No 12, p 2466-2501, Dec 1968. 36 p, 27 fig, 8 tab, 64 ref.

Descriptors: *Groundwater movement, *Compaction, *Consolidation, *Diagenesis, Permeability, Pressure, Earth pressure, Stress, Porosity, Sediments, Sedimentary rocks, Mud, Aquifers, Water sources.
Identifiers: *Japan, Oil migration, Reservoir dynamics.

The main hydrocarbon reservoirs in Nagaoka Plain, Japan, are volcanic and pyroclastic rocks. The migration of hydrocarbons seems to have occurred from adjacent sedimentary source beds to the volcanic reservoirs, facilitated by differential compaction. Therefore, it is possible to determine the directions of the compaction currents by using horizontal porosity distributions of covered mudstone bodies. The differential compaction maps of the mudst one source beds overlying the reservoirs may indicate the directions of hydrocarbon migration, and may suggest the location of hydrocarbon accumulations in Nagaoka Plain. The volumes of the compaction currents are estimated from the vertical porosity distributions and the porosity differences before and after compaction. The resultant figures in connection with the possible hydrocarbon accumulations. There are some abnormal pressures in the reservoirs of the Fujikawa, Kumo. The recent sedimentside, and Mitsuke gas and oil fields in the plain, whereas normal hydrostatic pressures are observed in the reservoirs of such fields as Katagai, Nishi-Nagaoka, and Higashi-Sanjo. This suggests the presence of permeability barriers in the volcanic reservoir rocks. The depths of the volcanic reservoirs and the thicknesses of the sealing mudstone beds are greater at Fujikawa, Kumoide, and Mitsuke, where abnormal pressures are found, than at Katagai, Nishi-Nagaoka, and Higashi-Sanjo, where reservoir pressures are hydrostatic. Therefore abnormal pressures in this district may be ascribed to the thick mudstone selas and overburden pressures. (Knapp-USGS)
W70-00246

ROCK VOLUME AND PORE VOLUME DATA FOR PLAINS REGION OF WESTERN CANADA SEDIMENTARY BASIN BETWEEN LATITUDES 49 AND 60 DEG N,
Research Council of Alberta, Edmonton.
Brian Hitchon.
Amer Ass Petrol Geol Bull, Vol 52, No 12, p 2318-2323, Dec 1968. 6 p, 4 fig, 5 tab, 9 ref.

Descriptors: *Porosity, *Sedimentary rocks, *Groundwater basins, Sandstones, Carbonate rocks, Limestones, Shales, Rock properties, Sedimentary petrology.
Identifiers: Canada, Alberta, Saskatchewan, Western Canada Sedimentary Basin.

Volumes of sandstone, shale, carbonate rocks, and evaporite, and pore volumes within each of these lithologic types, have been computed for 28 stratigraphic units in the plains region of the western Canada sedimentary basin. This region covers 486,785 sq mi and contains a total sedimentary fill of 537, 895 cu mi, with an average depth of 5,834 ft. Tertiary strata comprise 1.3%, Mesozoic strata 45.5%, and Paleozoic strata 53.2% of the total basin sedimentary fill. The average lithologic percentages for the total basin are: sandstone, 11.0; shale, 56.9; carbonate, 26.4; and evaporite, 5.7. The average basin porosity is 11.8%, with more than half the pore volume present in Mesozoic shale beds which comprise only 38% of the total basin fill. The average basin porosity for sandstone, shale, and carbonate is 15.7, 13.9, and 8.2%, respectively. The data are tabulated, with minimum comment, for reference purposes. (Knapp-USGS)
W70-00248

STUDY OF GROUND WATER FLOW IN JOINTED ROCKS AND ITS EFFECTS ON THE STABILITY OF SOLID ROCKS (FRENCH),
Technische Hochschule, Karlsruhe (West Germany).
Claude Louis.
Elec De France, Bull Dir Etud et Rech, Ser A, No 3, p 5-132, 1968. 128 p, 78 fig, 52 ref.

Descriptors: *Groundwater, *Groundwater movement, *Joints (Geology), *Rock mechanics, Discharge (Water), Fissures (Geology), Laminar flow, Turbulent flow, Mathematical studies, Hydraulic properties, Viscosity, Pressure, Tunnel construction, Dam foundations, Soil properties.
Identifiers: Analytical study of groundwater flow.

The phenomenon of flow in jointed media and the stresses transmitted by seeping water to fissured rock are discussed. Systems of plane parallel joints are also investigated because of their existence in the majority of rock massifs. Flows are governed mainly by the geometry of the joint systems if the permeability of rock material, compared to that of the joints, is negligibly small. The factors affecting the geometry of the joint systems are analyzed and flow equations for seepage through open or filled joints are developed by using the principles of theoretical hydraulics and model tests, taking into consideration the form and surface roughness of the joints. Based on this analytical study, graphical and analytical methods for the determination of the potential distribution in joint media are developed. The stresses transmitted by seeping waters consist of shear forces, seepage pressures, and bouyancy. (Gabriel-USGS)
W70-00249

INVESTIGATION OF WATER LOSSES TO SINKHOLES IN THE PAHASAPA LIMESTONE AND THEIR RELATION TO RESURGENT SPRINGS, BLACK HILLS, SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City.
For primary bibliographic entry see Field 02G.
W70-00310

A RADIOGRAPHIC METHOD OF DETERMINING THE DIRECTION OF GROUND WATER FILTRATION IN DRILL HOLES,
Hydrogeological Enterprise, Warsaw (Poland).
For primary bibliographic entry see Field 07B.
W70-00331

2G. Water in Soils

FACTORS AFFECTING INFILTRATION AND RECHARGE IN A LOESS COVERED BASIN,
Idaho Univ., Moscow.
Roy E. Williams, and David W. Allman.
J Hydrol, Vol 8, No 3, p 265-281, Jul 1969. 17 p, 13 fig, 16 ref. OWRR Proj No A-021-IDA.

Descriptors: *Infiltration, *Recharge, *Loess, Surface-groundwat er relationships, Soil water movement, Groundwater movement, Permeability, Anisotropy, Vegetation effects, Soil moisture, Tracers, Washington, Groundwater basins.
Identifiers: Loess recharge.

Hydrographs of shallow piezometers installed in a basin overlain primarily by loess reveal that water infiltrating and percolating through the loess recharges groundwater. Local gravity groundwater flow systems adjacent to some intermittent streams thereby are established. Relief on the water table is at a maximum during late winter or spring but decreases steadily through the summer when dry weather and maximal evapotranspiration minimize recharge. Several factors make the loess more or less susceptible to infiltration and percolation. Among the more important are cultivation practices and type of crop grown. Smooth, heavily worked surfaces (commonly planted in winter wheat) appear to act as a major limitation to infiltration capacity. Soil moisture concomitantly is low beneath such surfaces. Root mats developed beneath grassy surfaces provide optimal conditions for infiltration, and consequently for recharge. Measured infiltration capacities are often influenced by near vertical tabular openings extending to a depth of at least 30 ft in the loess. Tracer studies indicate that when sufficient water is available and when surficial infiltration capacity is sufficiently high to form a zone of positive pressure above these openings, they conduct water ahead of the saturation front. Water moves both downward in the openings and laterally into small rootlet holes in the matrix of the loess. By maximization of surface infiltration capacity it may be possible to utilize the tabular openings to induce groundwater recharge. (Knapp-USGS)
W70-00036

REDUCED SODIUM EXCHANGE CAPACITY IN UNSATURATED FLOW,
Technion - Israel Inst. of Tech., Haifa; and Ministry of Agriculture, Tel Aviv.
For primary bibliographic entry see Field 02K.
W70-00045

PEAT AND MUCK DRAINAGE PROBLEMS,
Agricultural Research Service, Athens, Ga. Southeast Watershed Research Center.
For primary bibliographic entry see Field 04A.
W70-00229

NATURAL RESOURCES OF UNDERGROUND WATERS CONFINED TO THE ZONE OF FREE WATER EXCHANGE OF THE IRKUTSK AMPHITHEATER (RUSSIAN),
Hydrogeological Station, Irkutsk (USSR).
For primary bibliographic entry see Field 02F.
W70-00233

DESALINATION UNDER THE CONDITIONS OF NO WATER DRAINAGE (RUSSIAN),
Tashkent Univ. (USSR).
For primary bibliographic entry see Field 03A.
W70-00237

BIOLOGY AND ECOLOGY OF NITROGEN.
California Univ., Davis.
For primary bibliographic entry see Field 02K.
W70-00277

NONSYMBIOTIC NITROGEN FIXATION IN TROPICAL SOILS,
For primary bibliographic entry see Field 02K.
W70-00288

MOISTURE AND ENERGY DISTRIBUTION WITHIN A SLOPING SOIL MASS DUE TO A FINITE DURATION STEADY RAINFALL,
North Carolina Water Resources Research Inst., Raleigh.
Tarit Kumar Sarkar.

University of North Carolina, Ph D Thesis, 1969. 106 p. OWRR Proj A-012-NC.

Descriptors: *Rainfall-runoff relationships, Slopes, Subsurface drainage, Time lag, *Unsaturated flow.

An effort to explain the physics of unsaturated moisture flow problems through an inclined soil mass, a 914 cm long, 76 cm wide, and 12 cm deep, designed and constructed so that it could be tilted at any slope between 0 to 10 percent. The flume was filled to a depth of four feet with mortar sand. A rainfall simulator was designed to create desired rainfall intensities on the top of the flume. Three slopes, zero percent, 1.3 percent and 6.2 percent, were studied with rainfall intensities of .0016 cm/sec for a period of 120 minutes, and .0011 cm/sec for a period of 120 minutes respectively. A computer model was developed to supplement the physical model. In general the observed and calculated moisture contents and pressure distributions agreed within plus or minus 20.0 percent. The agreement between the observed and calculated outflow volumes was very poor with a maximum difference of about-75.0 percent at about 3200 minutes after the start of the rainfall. However, when the outflow volumes were calculated from the observed moisture content distribution, the agreement with the calculated volume was within about -30.0 percent. It is the opinion of the writer that the digital computer is a valuable tool for solving soil moisture flow problems but that the computer model developed in this study needs modification to take care of the fluctuating water table problems. An improvement on the measurement and distribution of the inflow volumes is also required.
W70-00307

INVESTIGATION OF WATER LOSSES TO SINKHOLES IN THE PAHASAPA LIMESTONE AND THEIR RELATION TO RESURGENT SPRINGS, BLACK HILLS, SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City.
John Paul Gries.
So Dakota Water Resources Research Institute Project completion report, Sept 1969. 16 p, 1 fig, 10 ref, 2 append. OWRR Proj A-010-SDAK.

Descriptors: *Sinkholes, Caverns, *Water-loss, *Pahasapa Formation, Limestone, Black Hills, *South Dakota, *Springs.

Streams flowing radially from the Black Hills lose some or all of their water while crossing the outcrop of the Pahasapa (Madison) Limestone. Much is lost to sinkholes in the limestone, but some is temporarily lost to alluvium in the valley bottom. Careful geological examination of the stream channel at various stages of streamflow has located most of the points of water loss and return. Monthly discharge measurements have been made above, below, and between known points of loss on eight of the principal streams for a period of three years. The resultant profiles indicate free exchange between surface flow, flow through the alluvium, and flow through limestone cavern systems. Discharge measurements on resurgent springs indicates that most of the water lost to sinkholes returns to the surface. Temperature studies, and introduction of Rhodamine and fluorescein dye demonstrate that appreciable volumes of water regularly flow through the limestone by routes which are much more direct than the meandering path of the surface streams. They also suggest interdivide migration of water from one drainage basin to another. Observations during periods of high water and continuous flow across the zone of loss show that as the groundwater table rises, the ability of the subterranean passages to transmit water away from the intake area is reduced. Water losses to the sinkholes are consequently reduced until the water table returns to normal.
W70-00310

2H. Lakes

SOME REDUCTION AND OXIDATION PROCESSES IN THE BLACK SEA,
Akademiya Nauk URSR. Marine Hydrophysics Inst.
B. A. Skopintsev.
Oceanology, Vol 8, No 3, p 328-341, 1968. 14 p, 6 tab, 35 ref. Transl from Okeanologiya, Akad Nauk, SSSR, Vol 8, No 3.

Descriptors: *Saline water, *Saline lakes, *Water chemistry, *Reduction (Chemical), *Sea water, *Oxidation, Biological properties, Bicarbonates, Sulfates, Phosphorus, Phosphates, Nitrogen, Organic matter, Anaerobic conditions, Solubility, Chlorine, Sulfides, Hydrogen sulfide, Magnesium.
Identifiers: *Black Sea.

Reduction and oxidation processes taking place in the Black Sea were investigated on the basis of detailed chemical studies and earlier publications. The quantity of bicarbonate carbon found in deep water does not correspond to the overall amount of reduced sulphur (as sulfite). On the basis of the average ratio of nitrogen to phosphorus in mixed plankton, 1+ can be postulated that the amount of phosphate phosphorus formed in deep water is less than the amount of ammonia nitrogen, and that there is a decrease in mineral nitrogen content near the surface. Probable causes for the phenomena are the existence of anaerobic processes for the decomposition of organic matter, lesser phosphate solubility in deep water, and the occurrence of an intermediate denitrification zone. (Gabriel-USGS)
W70-00048

ADSORPTION AND DESORPTION OF RADIONUCLIDES BY SHALLOW-WATER SEDIMENTS OF THE BLACK SEA,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
For primary bibliographic entry see Field 02J.
W70-00049

THERMAL STRATIFICATION IN LAKES: ANALYTICAL AND LABORATORY,
University of Science and Technology, Kumasi (Ghana); and Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
Jonas M. K. Dake, and Donald R. F. Harleman.
Water Resources Research, Vol 5, No 2, p 484-495, Apr 1969. 8 fig, 1 tab, 20 ref.

Descriptors: *Thermal stratification, *Solar radiation, Lakes, Convective mixing, Heat transfer, Energy budget, Model studies, California.
Identifiers: Turbulent diffusion, Internal radiation, Thermal diffusion, Lake Tahoe, Vertical density, Variations.

Theories are developed for the time dependent vertical temperature distribution in a deep lake during the yearly cycle of solar heating and cooling. A heat flux balance at the water surface, which accounts for back radiation and evaporative heat loss, is formulated as a boundary condition. The linear, second-order heat transfer equation is solved by superposition of solutions for the surface absorbed radiation and the internally absorbed radiation. Analytical solutions are given for three different assumptions regarding the time dependence of the incoming radiation and the surface heat losses. At certain times, the resulting temperature and density distribution in the epilimnion are unstable. Under these conditions convective mixing and turbulent diffusion are accounted for by generating a surface mixed layer of uniform temperature, the depth determined by a thermal energy balance. The theory shows good agreement with field observations of temperature distributions in Lake Tahoe. Experiments are performed using artificial insolation (mercury vapor and infrared lamps) on a laboratory tank. We conclude that it is possible to simulate the development of thermal stratification under laboratory conditions. (Ross-Vanderbilt)
W70-00141

CIRCULATION AND THEMOCLINE DEVELOPMENT IN A ROTATING LAKE MODEL,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Donald R. F. Harleman, Robert M. Bunker, and James B. Hall.
Univ of Michigan, Great Lakes Research Division, Pub No 11, p 340-356, 1964. 11 fig, 3 ref.

Descriptors: *Currents (Water), *Coriolis force, *Thermal stratification, Winds, Great Lakes, Lake Michigan, Thermocline, Air circulation, Water circulation.

Model studies were made to determine the effects of coriolis force, thermal stratification and surface currents on circulation and thermocline in Lake Michigan during the summer season. Detailed investigations in both static and rotating models were made for two cases: (1) north and south wind components operating together and (2) south wind operating alone; and with: (1) isothermal lake, (2) 40-ft thermocline, and (3) 25-ft thermocline. Conclusions were, for surface currents: (1) Rotation of the lake model produces major changes in the pattern of surface currents, (2) The existence and depth of a thermocline has a definite effect on both the direction and the velocity of surface currents produced by a constant wind source. For temperature stratification, it was noted that (1) Upon the incidence of thermal heating at the lake model surface a thermocline was almost immediately formed, (2) A consistent temperature gradient occurs near the epilimnion zone, and (3) The shape of the clinolimnion zone indicates that temperature distribution may well follow diffusion theory. General conclusions were (1) Modeling of gravitational and coriolis forces is apparently feasible and (2) More data on actual conditions existing in Lake Michigan are required before accurate modeling can be obtained. (Guerrero-Vanderbilt)
W70-00153

DEATH OF A LAKE,
For primary bibliographic entry see Field 05C.
W70-00264

CHARACTERISTICS OF HYPERTROPHIC LAKES AND CANALS IN CITIES,
State Zoological Inst. and Museum, Hamburg (West Germany). Hydrobiological Station.
For primary bibliographic entry see Field 05C.
W70-00268

THE DIATOMS OF A CORE FROM ESTHWAITE WATER,
Bristol Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 05C.
W70-00271

CONTRIBUTION TO THE ECOLOGY OF WATER-BLOOM-FORMING BLUE-GREEN ALGAE -APHANIZOMENON FLOS AQUAE AND MICROCYSTIS AERUGINOSA,
Ceskoslovenska Akademie Ved, Prague. Hydrobiological Station.
For primary bibliographic entry see Field 05C.
W70-00274

INFLUENCE OF ELECTRIC POWER PLANT ON LIMNOLOGICAL CONDITIONS OF RESERVOIRS (IN GERMAN),
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia).
For primary bibliographic entry see Field 05C.
W70-00293

THE LIMNOBIOCHEMISTRY OF DEVILS LAKE, NORTH DAKOTA,
North Dakota Univ., Grand Forks.
For primary bibliographic entry see Field 05C.
W70-00311

HEAT BUDGET OF AN ICE COVERED INLAND LAKE,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02C.
W70-00317

2I. Water in Plants

BIOLOGY AND ECOLOGY OF NITROGEN.
California Univ., Davis.
For primary bibliographic entry see Field 02K.
W70-00277

THE NITROGEN ECONOMY OF GRASSLAND AND DUNE SOILS,
Oak Ridge National Laboratory, Tenn. Radiation Ecology Section; and Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 02K.
W70-00284

AN INVESTIGATION OF THE NITROGEN-FIXING ABILITY OF NATIVE CHILEAN RHIZOBIA STRAINS AND SOME PROBLEMS RELATED TO THEIR SYMBIOSIS WITH SEVERAL LEGUMES,
Concepcion Univ. (Chile). Departamento de Microbiologia.
For primary bibliographic entry see Field 02K.
W70-00286

INOCULATION OF LEGUMES IN BRAZIL,
Rio Grande do Sul, Porto Alegre (Brazil). Faculdade de Agronomia e Veterinaria.
For primary bibliographic entry see Field 02K.
W70-00287

PHYSIOLOGY OF THE SYMBIOSIS BETWEEN RHIZOBIUM AND LEGUMINOUS PLANTS,
Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.
For primary bibliographic entry see Field 02K.
W70-00290

2J. Erosion and Sedimentation

COMPARISON OF MORAINES FORMED BY SURGING AND NORMAL GLACIERS,
Geological Survey of Canada, Calgary (Alberta).
For primary bibliographic entry see Field 02C.
W70-00007

A NEWLY-IDENTIFIED PROCESS OF POINT BAR FORMATION IN NATURAL STREAMS,
Sydney Univ. (Australia). Dept. of Geography.
Edward J. Hickin.
Amer J Sci, Vol 267, No 8, p 999-1010, Oct 1969. 12 p, 4 fig, 4 plate, 8 ref.

Descriptors: *Sedimentation, *Alluvial channels, *Meanders, *Sedimentary structures, Model studies, Hydraulic models, Bank erosion, Stratigraphy, Stream erosion, Channel morphology, Flood plains, Turbulent flow, Supercritical flow.
Identifiers: *Point bars, Point dunes.

Sedimentation on stream bends developed at supercritical flow in a sand bed flume is examined in terms of a five-stage model. The model outlines the process by which deposits on the convex sides of meanders (point dunes) are formed. This mode of deposition, distinctly different from overbank and lateral accretion, also occurred at existing bends of the flume channel when the flow was subcritical and non meandering. Point dunes, which are examples of a feature in dynamic equilibrium, may also occur naturally when streams flowing over coarse noncohesive material are forced to change direction at valley bends. Field evidence, including a pilot mechanical analysis of sediment from a natural point dune, is presented which strongly supports the possibility. The significance and implications of the possible accordance of point dune and flood plain surfaces are discussed briefly. (Knapp-USGS)
W70-00034

A MATHEMATICAL THEORY ABOUT SAND WAVES AND ITS APPLICATION ON THE DUTCH WADDEN ISLE OF VLIELAND,
Netherlands Rijkswaterstaat, Arnhem. Engineering Dept. of Coastal Research.
W. T. Bakker.
Shore and Beach, Vol 36, No 2, p 5-14, Oct 1968. 10 p, 12 fig, 1 tab, 6 ref.

Descriptors: *Beach erosion, *Forecasting, *Mathematical models, Sediment transport, Sand waves, Ocean waves, Shore protection, Waves (Water), Currents (Water).
Identifiers: Netherlands, Vlieland.

A mathematical method is presented for predicting coastal erosion or aggradation using a series of yearly measurements of high and low water lines. The method was developed using data from the Dutch Wadden Isle of Vlieland, and proved useful in projecting erosion of the Isle's Coast. (Knapp-USGS)
W70-00043

URANIUM AND RADIUM IN THE SURFACE LAYER OF OCEANIC SEDIMENTS,
Yu. A. Kuznetsov, Z. N. Simonyak, A. P. Lisitsyn, and M. S. Frenklikh.
Geochem Int, Vol 5, No 2, p 306-313, 1968. 8 p, 3 tab, 28 ref. Transl from Geokhimiya, USSR, No 3, p 323-333, 1968. Published by Geochemical Society.

Descriptors: *Uranium radioisotopes, *Radium radioisotopes, *Surface waters, *Sediments, *Indian Ocean, Sea water, Sampling, Deposition (Sediments), Chemical analysis, Petrology, Seashores, Carbon, Iron, Silica, Calcium carbonate, Titanium, Phosphorus, Organic matter.
Identifiers: Oceanic sediments.

A study has been made of the spatial distribution of uranium and radium in the surface layer of Indian Ocean sediments. Several samples from the central and southern parts of the Ocean were examined. Eighteen of the 50 samples contain radium deposited directly from the water by sorption on the particles and uranium coprecipitates with dead organisms, phosphates, and hydroxides of Fe and Mn. The uranium content of the samples shows that there is no obvious correlation with the type of sediments, depth, or sampling position (distance from shore). (Gabriel-USGS)
W70-00044

SHORE EROSION OF THE NORTHERN CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.; and Johns Hopkins Univ., Baltimore, Md. Dept. of Oceanography.
J. R. Schubel.
Shore and Beach, Vol 36, No 1, p 22-26, Apr 1968. 5 p, 6 fig, 2 ref.

Descriptors: *Erosion, *Sedimentation, *Estuaries, Sediment yield, Provenance, Sediment transport, Deposition (Sediments), Waves (Water), Currents (Water), Sands, Silts, Clays.
Identifiers: *Chesapeake Bay.

The mass of material eroded yearly from the shores of Chesapeake Bay is estimated by combining measurements of areal loss with relief data from topographic maps and field measurements. Cores show that very little eroded sand and gravel escapes the nearshore zone. Silts and clays, which make up 25-53% of the total eroded material, are transported much farther. Total annual shore sediment removal is about 0.3 million tons, of which about 0.1 million tons are silt and clay. River runoff contributes about 5 times this amount yearly, or about 0.20 inches of bay sedimentation per year of a total sedimentation of about 0.24-0.27 inches per year. (Knapp-USGS)
W70-00047

ADSORPTION AND DESORPTION OF RADIONUCLIDES BY SHALLOW-WATER SEDIMENTS OF THE BLACK SEA,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
D. D. Baranova, and G. G. Polikarpov.
Oceanology, Vol 8, No 3, p 341-344, 1968. 4 p, 5 tab, 6 ref. Transl from Okeanologiya, Akad Nauk, SSSR, Vol 8, No 3.

Descriptors: *Sediments, *Shallow water, *Adsorption, *Radioisotopes, Cesium, Silts, Carbonates, Chlorides, Gaging stations, Sampling, Water chemistry, Mussels.
Identifiers: *Black Sea sediments.

Shallow water sediments of the Black Sea were analyzed for the presence of rare elements. Among the sediments studied, the shallow-water silts exhibit a large absorptivity for Sr-90, Zr-95, Ru-106, Cs-137, and Ce-144. Phaseoline silt and aleuritic silt with mussel biocoenosis most effectively absorb Y-91, Zn-95, Cs-137, and Ce-144, but their affinity coefficients for Sr-90 and Ru-106 are low. The high rate or removal of Y-91 and Ce-144 from these silts by 0.2N HCl correlates with the presence of mineral carbonate in the silt. (Gabriel-USGS)
W70-00049

THE USE OF THE SAND-TRANSPORTING PROPERTIES OF WAVES IN LITTORAL DRIFT STUDY,
Akademiya Nauk SSSR. Institut Okeanologii.
M. G. Yurkevich.
Oceanology, Vol 8, No 3, p 352-359, 1968. 8 p, 3 fig, 3 tab, 16 ref.

Descriptors: *Waves (Water), *Littoral drift, *Sands, *Sediment transport, Coasts, Winds, Hydrologic data, Meteorological data, Wind velocity, Energy transfer, Dynamics, Frequency, Statistical methods, Geology.
Identifiers: *USSR, Baltic coast.

Sand transporting properties of waves were analyzed on the basis of hydrometeorological observations recorded at three Baltic coast stations during the 1953-1964 period, and using an energy method. There are large variations in the sand-transporting characteristics when examined over a period of years. In the windiest years all the sand-transport parameters are 3-5 times those of the least windy years. The annual mean values of the sand-transporting parameters indicate that the energy-producing resultant force always lies to the right of the normal and forms an angle with it. (Gabriel-USGS)
W70-00050

THE BALANCE OF SEDIMENTARY MATERIAL IN THE SEA OF AZOV,
Karaganda Polytechnical Inst. (USSR); and Akademiya Nauk SSSR. Institut Okeanologii.
Yu P. Khrustalev, and F. A. Shcherbakov.
Oceanology, Vol 8, No 3, p 360-366, 1968. 7 p, 3 fig, 1 tab, 22 ref. Transl from Okeanologiya, Akad Nauk, SSSR, Vol 8, No 3.

Descriptors: *Sedimentation, *Sediment discharge, River flow, Bottom sediments, Erosion, River basins, Coasts, Abrasion, Dissolved solids, Estuaries, Geology, Silts, Sands, Shoreline cover, Carbonates, Mussels, Suspended load.
Identifiers: *Sea of Azov, *USSR.

Possible sources of sedimentary material in the Sea of Azov were investigated by taking into consideration the discharges of the Don and Kuban Rivers, shore erosion, and bottom erosion of the Sea of Azov. The rivers supply 19 million tons of material into the sea, and the shore erosion and bottom erosion products are estimated to be 17 million tons and 11 million tons, respectively. On the whole, river-derived material plays a significantly smaller role in the sediment balance of the Sea of Azov, than it does in the case of intracontinental water bodies. (Gabriel-USGS)
W70-00051

AN OPERATIONS RESEARCH APPROACH TO BASIN SEDIMENT CONTROL,
Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering Science.
For primary bibliographic entry see Field 04D.
W70-00060

GEOLOGIC AND GEOGRAPHIC CONTROLS UPON THE RATE OF SOLUTE REMOVAL FROM SELECTED COASTAL RIVER BASINS BETWEEN HALF MOON BAY AND DAVENPORT, CALIFORNIA,
Miami Univ., Oxford, Ohio.
For primary bibliographic entry see Field 02L.
W70-00067

MASS WASTING IN COASTAL ALASKA,
Forest Service (USDA) Pacific Northwest Forest and Range Experiment Station, Juneau, Alaska.
Douglas N. Swanston.
USDA Forest Serv Res Pap PNW-83, 1969. 15 p, 10 fig, 10 ref.

Descriptors: *Mass wasting, *Landslides, *Slope stability, *Debris avalanches, *Glacial soils, *Colluvium, Sediment yield, Soil erosion, Engineering geology, Soil engineering, Alaska.
Identifiers: Clear cuttings, Logged areas, Debris flows, Debris torrents, Southeast Alaska.

Mass wasting, a dominant form of slope reduction in coastal Alaska, is common where slopes are oversteepened by glacial erosion, soils are recent and shallow, and there is abundant rainfall. Timber harvesting by clear cutting appears to accelerate debris avalanching and debris flows. The most practical current policy to avoid landslide acceleration by timber harvesting is avoidance of slide susceptible areas. Old debris avalanche and flow scars are visible on aerial photos, but a more accurate evaluation of slide susceptibility can be made from a slope gradient map, which can be used to delineate potential slide areas and plan cutting patterns likely to cause the least slope disturbance. (Helmers-Forest Service)
W70-00164

SEDIMENT MEASUREMENT TECHNIQUES: A. FLUVIAL SEDIMENT,
Geological Survey, Washington, D.C.
Paul C. Benedict.
Prepared for Task Comm on Prep of Sedimentation Manual, Comm on Sedimentation, Hydraul Div, Vito A. Vanoni, Chairman. ASCE Proc, J Hydraul Div, Vol 95, No HY5, Pap 6756, p 1477-1514, Sept 1969. 38 p, 29 fig, 2 tab, 49 ref.

Descriptors: *Sediment load, *Sampling, *Measurement, Instrumentation, Sedimentation, Stream erosion, Scour, Sediment transport, Bed load, Suspended load, Statistical methods, Sediment discharge, Sediment yield, Frequency analysis.
Identifiers: Fluvial sediment measurement.

A description is given of modern techniques and equipment used to plan and make sedimentation measurements on natural streams. First, typical examples are given of sedimentation characteristics such as distribution of sediment with distance above the bed and variation of concentration with time and position in the stream cross section, for the purpose of illustrating some of the problems of sediment measurement. Equipment available is then described for obtaining suspended load concentration, bed load discharge and bed sediment samples. Next, the planning is outlined for making measurements at a cross section to obtain the sediment discharge of a stream and the procedure is presented for making the necessary calculations based on measured data. Finally the method of obtaining long-time records of sediment discharge is considered. This includes the determination of the frequency of making measurements in order to achieve the desired accuracy. The report is intended for the use of engineers not familiar with sediment measurement techniques on streams. (Knapp-USGS)
W70-00214

SEDIMENT MEASUREMENT TECHNIQUES: F. LABORATORY PROCEDURES,
Geological Survey, Washington, D.C.
Harold P. Guy.
Prepared for Task Comm on Prep of Sedimentation Manual, Comm on Sedimentation, Hydraul Div, ASCE. ASCE Proc, J Hydraul Div, Vol 95, No HY5, Pap 6757, p 1515-1543, Sept 1969. 29 p, 7 fig, 5 tab, 21 ref.

Descriptors: *Sediments, *Laboratory tests, *Sampling, Measurement, Particle size, Particle shape, Turbidity, Bed load, Suspended load, Logging (Recording), Instrumentation, Chemical analysis, Sedimentology, Settling velocity.
Identifiers: Sedimentation tubes, Sediment measurement.

A description is given of the technique and apparatus used in laboratory measurements usually made in connection with field sedimentation investigations. The expected and needed accuracy and reliability of measurements is first discussed. The various methods for determining sediment concentration in samples and forms for logging sample and laboratory data are presented. A number of methods for determining particle size and particle size-distribution are then described. These include the visual accumulation tube method and the bottom withdrawal tube method developed in recent years by several U. S. Government agencies as well as classical methods such as sieving and the pipet method. The final section deals with the less common measurement such as determination of the content of organic matter in sediment samples and dissolved solids in the water of the samples. The report is intended for the use of engineers not familiar with laboratory sediment measurements. (Knapp-USGS)
W70-00215

INSTABILITY OF FLAT BED IN ALLUVIAL CHANNELS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-00217

THE NEAR-SHORE SHALLOWS OF WESTERN CUBA AND THEIR SEDIMENTS (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02L.
W70-00234

COMPACTION AND MIGRATION OF FLUIDS IN MIOCENE MUDSTONE, NAGAOKA PLAIN, JAPAN,
Japan Petroleum Development Corp., Tokyo.
For primary bibliographic entry see Field 02F.
W70-00246

CONTEMPORARY NONMARINE SEDIMENTATION IN SOVIET CENTRAL ASIA,
Tulsa Univ., Okla.
Parke A. Dickey.
Amer Ass Petrol Geol Bull, Vol 52, No 12, p 2396-2421, Dec 1968. 26 p, 10 fig, 11 tab, 76 ref.

Descriptors: *Sedimentation, *Reviews, *Bibliographies, *Sedimentation rates, *Sedimentary basins (Geological), Provenance, Sediment yield, Deposition (Sediments), Geology, Sediment transport, Sediment distribution, Sediment load.
Identifiers: *Soviet Central Asia, Nonmarine sedimentation.

In Soviet central Asia sediments are being deposited in a wide variety of nonmarine environments. This is an area containing large inland seas similar to those that must have been present in the U.S. several times in the geologic past. Many ancient rock units were formed in epicontinental seas under similar conditions. The Caspian Sea is a huge lake of brackish water on whose margins are deltas of rivers, some draining tectonically active and other tectonically stable areas. Sands, muds, carbonates, and evaporites are being deposited in the sea, and their areal patterns can be related both to bathymetry and oceanography. East of the Caspian is a desert, partially covered by recent windblown sand. Rivers from high mountains on the south flow onto the desert, depositing broad areas of fine-grained, fluvial sand and silt. The Aral Sea is a smaller inland lake with two important deltas and a variety of bottom sediments. The recent sediments have been studied by Russian geologists and oceanographers for more than 30 years. Their work is described in several monographs and many technical articles, and a review of their work is presented. (Knapp-USGS)
W70-00247

AUTOMATIC BED DATA ABSTRACTING USING A HYDRAULIC SCALE MODEL (FRENCH),
Department of National Hydrology (France).
J. P. Lepetit, and M. Hariguillie.
Elec De France, Bull Dir Etud et Rech, Ser A, No 3, p 133-148, 1968. 16 p, 11 fig, 3 ref.

Descriptors: *Model studies, *Erosion, *Silting, Charts, Instrumentation, Application equipment, Topography, Bedrock, Transportation, Suspended load, Sedimentation.
Identifiers: Hydraulic scale model.

An automatic streambed charting method using hydraulic model data is described. This method is also suitable for recording changes taking place between two successive surveys of erosion and silting and for calculating the volume of material moved. A bed probe covering the whole model collects the data which are converted to numerical form and transferred to a suitable IBM tape. This tape is processed by a computer after which a microfilm curve plotter generates bed charts giving constant sedimentation and erosion lines. The computer programs and instructions for their use are included. (Gabriel-USGS)
W70-00250

ON THE NATURE OF THE PERIODICITY OF WAVES ON THE SURFACE OF A NONCOHESIVE MEDIUM (A CRITICAL REVIEW OF THE TURBULENCE HYPOTHESIS),
B. A. Shulyak.
Transl from Okeanologiya, Akad Nauk, SSSR, Vol 8, No 6. Oceanology, Vol 8, No 6, p 785-791, 1968. 7 p, 2 fig, 1 tab, 21 ref.

Descriptors: *Sand waves, *Ripple marks, *Sedimentary structures, Currents (Water), Winds, Turbulence, Channel morphology, Model studies, Hydraulic models, Turbulent flow, Vortices, Mathematical studies, Equations, Sands, Silts, Sediments, Sedimentation.
Identifiers: *Waves (Noncohesive media).

The turbulence hypothesis of the formation of periodic waves, including dunes, ripple marks, etc. on the surface of a noncohesive medium is subjected to critical examination. It is shown that observational determinations of the relationship between periodicity and properties of the particles as well as the generation of waves under reverse motion conditions are not compatible with the tur-

bulence hypothesis. A mechanism for the generation of periodicity in wave-induced ripples is advanced. This has been described in previous papers by the author and it has been recently confirmed for ripples in a channel. (Knapp-USGS)
W70-00252

GEOMORPHIC EFFECTS OF FLOODS IN THE ORERE RIVER CATCHMENT, EASTERN HUNUA RANGES,
Auckland Univ. (New Zealand). Dept. of Geography.
C. F. Pain.
J Hydrol, New Zeal, Vol 7, No 2, p 62-74, 1968. 13 p, 4 fig, 1 tab, 24 ref.

Descriptors: *Erosion, *Floods, *Geomorphology, Debris avalanches, Landslides, Mass wasting, Soil erosion, Vegetation effects, Canyons, Cloudbursts, Flood damage, Sediment yield, Slopes, Storms, Topography.
Identifiers: *New Zealand.

The supply of sediment to the channel network and the movement of this material down channel during high-intensity, low-frequency rainstorms is discussed with special reference to the Orere River catchment, New Zealand. Differences in channel form and process in forested and grassed catchments are noted. Under forest, debris flows are important in first-order channels where they remove infill from the channel bed and destroy vegetation beside the channel. Under grass these effects are not so marked. Slope failure under forest contributes vegetation, including large trees, which form debris dams in low-order channels. This rarely occurs under grass. Aggradation behind these obstacles slows down sediment transport, so that under forest the movement of material down channel is intermittent, while under grass it appears to be a relatively steady process. Evidence is presented to show the importance of low-frequency, high-intensity rainstorms as geomorphic factors. These storms cause marked slope failure and a catastrophic increase in debris supply to the channel network. It is suggested that concepts of magnitude and frequency of geomorphic forces need to be modified for areas where slope failure contributes most of the debris to the channel network. (Knapp-USGS)
W70-00254

INVESTIGATION OF QUANTITATIVE DISTRIBUTION OF SUSPENSION IN COASTAL WATERS OF THE WHITE SEA,
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02L.
W70-00259

SEDIMENT RATING CURVES IN EPHEMERAL STREAMS,
Agricultural Research Service, Tucson, Ariz.
Kenneth G. Renard.
Trans Amer Soc Agr Eng, Vol 12, No 1, p 80-85, Jan-Feb 1969. 6 p, 6 fig, 4 tab, 9 ref.

Descriptors: *Ephemeral streams, Hydrology, Sampling, Sediments, Time, *Sedimentation, Arizona, Arid lands, Semiarid land, Suspended sediments, Storms, Runoff, Surface runoff, Watersheds (Basins), Hydrometeorological station, *Sediment production, Gaging stations, *Sediment concentration, Soil erosion, *Stream erosion.
Identifiers: *Sediment rating curves, *Sediment samplers, Multiple regression, *Sediment-water relationship, Walnut Gulch Watershed (Ariz).

A sediment-sampling program was conducted on an ephemeral stream of the Walnut Gulch experimental watershed in Arizona in 1963-1964. Sediment concentration in an ephemeral stream, where runoff is generated from only a portion of the contributing watershed, is related to several independent variables indicative of the flow and hydrologic conditions at the time of the sample. Although a large amount of unanswered variability remains, the multiple-linear-regression technique answers some problems of a sediment-rating curve for semiarid ephemeral streams. Sediment concentration is not predictable using a simple additive equation involving coefficients of the independent variables involved. A better relationship is a multiplicative equation involving products of the independent variables with different exponents. Lapse time from the beginning of flow at the sampling station and the instantaneous discharge at the time of sampling were the 2 most important variables for predicting sediment concentration. Other variables were important in reducing the unexplained variance, but were more inconsistent between the stations considered in the analysis and were important rather for the sand, silt, or clay fractions of the total concentration.
W70-00343

2K. Chemical Processes

URANIUM AND RADIUM IN THE SURFACE LAYER OF OCEANIC SEDIMENTS,
For primary bibliographic entry see Field 02J.
W70-00044

REDUCED SODIUM EXCHANGE CAPACITY IN UNSATURATED FLOW,
Technion - Israel Inst. of Tech., Haifa; and Ministry of Agriculture, Tel Aviv.
R. S. Mokady, and E. Bresler.
Soil Sci Soc Amer Proc, Vol 32, No 4, p 463-467, July-Aug 1968. 5 p, 7 fig, 2 tab, 11 ref.

Descriptors: *Ion exchange, *Soils, *Unsaturated flow, *Aqueous solutions, Electrolytes, Anisotropy, Ion transport, Leaching.
Identifiers: Ion exchange capacity (Soils).

The effective or apparent cation exchange capacity (E.C.) in flow through sandy-soil columns is reduced as the moisture content reduces. From experimental data it can be inferred that unsaturated flow may render the soil anisotropic for ion diffusion. In any case the leaching pattern appears as if some of the sites for ion exchange are not readily accessible under unsaturated flow. (Knapp-USGS)
W70-00045

QUANTITATIVE ANALYSIS FOR CORROSION STUDIES BY THE MOSSBAUER EFFECT,
Princeton Univ., N.J. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 08G.
W70-00046

SOME REDUCTION AND OXIDATION PROCESSES IN THE BLACK SEA,
Akademiya Nauk URSR. Marine Hydrophysics Inst.
For primary bibliographic entry see Field 02H.
W70-00048

ADSORPTION AND DESORPTION OF RADIONUCLIDES BY SHALLOW-WATER SEDIMENTS OF THE BLACK SEA,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
For primary bibliographic entry see Field 02J.
W70-00049

GEOLOGIC AND GEOGRAPHIC CONTROLS UPON THE RATE OF SOLUTE REMOVAL FROM SELECTED COASTAL RIVER BASINS BETWEEN HALF MOON BAY AND DAVENPORT, CALIFORNIA,
Miami Univ., Oxford, Ohio.
For primary bibliographic entry see Field 02L.
W70-00067

SALTWATER INTRUSION IN THE UNITED STATES.
For primary bibliographic entry see Field 02F.
W70-00211

TRITIUM IN THE EQUATORIAL ATLANTIC CURRENT SYSTEM,
Miami Univ., Fla. Inst. of Marine Sciences.
H. Gote Ostlund, Murice O. Rinkel, and Claes Rooth.
J Geophys Res, Vol 74, No 18, p 4535-4543, Aug 20, 1969. 9 p, 6 fig, 2 tab, 16 ref. NSF Grants GP-1446, GP-3353, GP-5096.

Descriptors: *Tritium, *Atlantic Ocean, *Currents (Water), Sampling, Analytical techniques, Sea water, Salinity, Water temperature, Air circulation, Water transfer, Underflow, Equipment, Instrumentation.
Identifiers: *Equatorial Atlantic current.

This article describes improved sampling and analytical techniques for detection of ultra-low specific activity of tritium in sea water. Tritium data, salinity, and temperature as recorded by the Equalant III expedition of 1964 are presented. Negligible tritium penetration was found below the areal thermocline. Tritium-salinity relations support the concept that molecular exchange constitutes a major portion of the air to sea tritium flux. A time scale of a few years seems reasonable for transfer of distant surface water to the salinity and current cores of the Equatorial Atlantic undercurrent. (Gabriel-USGS)
W70-00224

PYROLYSIS OF HUMIC AND FULVIC ACIDS,
Geological Survey, Denver, Colo.
R. L. Wershaw, and G. E. Bohner, Jr.
Geochim et Cosmochim Acta, Vol 33, p 757-762, 1969. 6 p, 3 fig, 1 tab, 23 ref.

Descriptors: *Soil chemistry, *Humic acids, *Fulvic acids, Gas chromatography, Analytical techniques, Aromatic compounds, Soil chemical properties.
Identifiers: *Pyrolysis, Mass spectrometry, Polysaccharides.

Pyrolysis of humic and fulvic acids isolated from a North Carolina soil yields a variety of aromatic, heterocyclic and straight chain organ compounds. The pyrolysis products identified by gas chromatography and mass spectrometry indicate that humic and fulvic acids have aromatic and polysaccharide structures in their molecules. (Knapp-USGS)
W70-00241

CALCULATIONS PERTAINING TO THE DESALINATION OF SALT-CONTAINING FORMATIONS UNDERLAIN BY AN AQUIFER OF GOOD PERMEABILITY (RUSSIAN),
Sredneaziatskii Nauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
For primary bibliographic entry see Field 03A.
W70-00243

INTERACTION OF DETRITUS WITH HIGH-MOLECULAR-WEIGHT COMPONENTS OF DISSOLVED ORGANIC MATTER IN SEA WATER,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
K. M. Khaylov, and Z. Z. Finenko.
Oceanology, Vol 8, No 6, p 776-785, 1968. 10 p, 7 fig, 14 ref. Transl from Okeanologiya, Akad Nauk, SSSR, Vol 8, No 6.

Descriptors: *Water chemistry, *Organic matter, *Solutes, *Sediments, *Sea water, Detritus, Chemical reactions, Absorption, Microorganisms, Aquatic microorganisms, Biodegradation, Nutrients.
Identifiers: *Macromolecular organic matter.

The physicochemical (sorption) and biochemical (microorganism-conditioned) interaction of surface-active macromolecular substances, recently

detected in sea water, with natural detritus and with organic matter in suspension are examined. In experiments with microorganism-populated natural detritus, it was shown that enzymatic hydrolysis of sorbed macromolecules takes place at the detritus surface, accompanied by sorption of fresh macromolecules from solution. As a result, a steady flow of material may exist in the 'dissolved marine organic matter - detritus' system. Under experimental conditions, the rate of this flow is about 3% of dissolved sea water macromolecules per day. It is suggested that a definite portion of the dissolved organic matter of sea water is brought into the food chain by consumption of detritus by filtering organisms. (Knapp-USGS)
W70-00258

SPECTROPHOTOMETRIC DETERMINATION OF CHROMIUM WITH XYLENOL ORANGE AND METHYLTHYMOL BLUE,
Missouri Univ., Kansas City. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W70-00260

MANGANESE AND RELATED ELEMENTS IN THE INTERSTITIAL WATER OF MARINE SEDIMENTS,
California Univ., Los Angeles, Dept of Geology; and California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 02L.
W70-00262

AMMONIA NITROGEN LOSSES FROM STREAMS,
San Diego State Coll., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W70-00267

BIOLOGY AND ECOLOGY OF NITROGEN.
California Univ., Davis.

Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program, National Research Council. National Academy of Sciences, Washington, DC, publisher, 1969. 165 p, 10 fig, 36 tab, 310 ref. Proceedings of Conference California Univ, Davis, 28 Nov-1 Dec 1967.

Descriptors: *Nitrogen, *Nitrogen cycle, *Nitrogen fixation, *Physiological ecology, Nutrients, Nutrient cycling, Plant physiology, Symbiosis, Legumes, Fertilizers, Ecosystems, Crops, Productivity, California, Soils, Tropical regions, Grasslands, Dunes.
Identifiers: Biogeochemistry, Nutrient sources, Food production, Nitrogen balance, Brazil, Chile, Rhizobium, Nitrogen sources (Industrial), Nitrogen sources (Biological).

This report embodies the deliberations of a conference called to establish priorities for research and to consider means to improve coordination of studies in connection with the effect of nitrogen (N) on organisms and their environments, particularly as these relate to global food production. Scope of the technical considerations is indicated by subjects of individual contributions, which have been abstracted separately: biogeochemistry of N; marine N-cycle; symbionts of N-fixing plants; inputs for maximum productivity; significance of N-balances for nitrification; N-storage in California ecosystems; N-economy in grasslands and dunes; effects on soil productivity of N from legumes and crop residues; N-fixation by Chilean rhizobia and their symbiosis with legumes; inoculation of Brazilean legumes; nonsymbiotic N-fixation in tropics; importance of nonsymbiotic organisms in N-economy of tropics; and physiology of Rhizobium-legume symbiosis. In addition to details of technical deliberations, report includes a summary, findings, and recommendations; appendices encompassing a prospectus for comparing biological N-fixation with industrial sources, and a list of participants is also included. (See also W70-00278 thru W70-00290). (Eichhorn-Wisconsin)
W70-00277

THE BIOGEOCHEMISTRY OF NITROGEN,
California Univ., Davis. Dept. of Soils and Plant Nutrition.
C. C. Delwiche.
Biology and Ecology of Nitrogen, p 10-15, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 1 fig. Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967.

Descriptors: *Nitrogen, *Nitrogen fixation, *Nitrogen cycle, *Photosynthesis, Ammonia, Nitrates, Nitrites.
Identifiers: *Biogeochemistry, *Food quality, Nitrogen (Industrial).

A general discussion of biology and ecology of nitrogen, or, more precisely, of the effect of nitrogen on organisms and environment. The report stresses the need for an exact appraisal of the relative potential significance of symbiotic, nonsymbiotic, and industrial nitrogen fixation as related to the industrial application of photosynthetic reactions and the quality of produced crops. (See W70-00277). (Wilde-Wisconsin)
W70-00278

THE NITROGEN CYCLE IN THE SEA,
Washington Univ., Seattle. Dept. of Oceanography.
R. C. Dugdale.
Biology and Ecology of Nitrogen, p 16-18, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program, National Academy of Sciences, Washington, DC, publisher. 9 ref. Proceedings of Coneerence, California Univ, Davis, 28 Nov-1 Dec 1967.

Descriptors: *Nitrogen cycle, *Oceans, *Tropical regions, *Nitrogen fixation, *Kinetics, Phytoplankton, Zooplankton, Turnovers, Cyanophyta, Ureas, Eutrophication.
Identifiers: *Euphotic zone, *Marine deserts, Michaelis-Menton formula, Isotope-dilution measurements, Glycine, Algal blooms.

The use of nitrogen-15 suggested that the bulk of combined nitrogen (N) in deep sea waters is present as nitrate. The active N-cycle is largely confined to the upper layer of several hundred meters. Maximum activity is in the euphotic zone where phytoplankton consumes nitrates and ammonia released by zooplankton and bacteria. Nitrate accounts for 30% of N in productive regions, but for only 1% in 'deserts' of tropical seas. Kinetics for algal uptake of ammonia give estimate for Michaelis-Menton constant, K - 1 microgram-atom N/liter. Turnover time for ammonia in productive surface waters is about 40 hours; that of nitrate, about 50 hours. Combined N is provided by fixation of blue-green algae, particularly by Trichodesmium spp, forming heavy blooms and delivering as much as 0.32 kilogram N/hectare/day. Low oceanic oxygen levels, attaining less than 0.3% saturation, induce substantial denitrification. Uptake of labeled urea and glycine can be demonstrated, and some algae can use a variety of organic N-sources. (See W70-00277). (Wilde-Wisconsin)
W70-00279

NITROGEN-FIXING PLANTS AND THEIR SYMBIONTS,
South Dakota State Univ., Brookings. Dept. of Bacteriology.
R. M. Pengra.
Biology and Ecology of Nitrogen, p 19-24, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program, National Academy of Sciences, Washington, DC, publisher. 14 ref.

Descriptors: *Nitrogen fixation.
Identifiers: *Plants (Nonleguminous), *Symbionts, *Leaf nodules, Phychotria bacteriophila, Klebsiella rubiacearum, Cross-inoculation, Aerobacter, Streptomycete endophytes, Fungal endophytes, Myrica, Alnus, Casuarinales, Ceanothus, Elaegnus, Rhamnus.

The nonleguminous plants capable of utilizing molecular nitrogen (N) include species of Alnus, Myrica, Casuarinales, Ceanothus, Elaegnus, Rhamnus, Hippophae, and Shepherdia. N-fixation in Phychotria bacteriophilia is accomplished by leaf nodules harboring Aerobacter (Klebesiella rubiacearum). Claims have been made that certain pines in association with fungus or fungal endophyte utilize molecular nitrogen. The streptomycete endophyte in the parenchymal cells of roots of Alnus glutinosa is believed to comprise three evolutionary forms: hyphal, vesicular, and bacteroidal. No streptomycete endophyte has been thus far isolated. Cross inoculation has been shown between species of Alnus and the family of Elaegnaceae. In all cases N-fixation required the presence of molybdenum. (See W70-00277). (Wilde-Wisconsin)
W70-00280

INPUTS FOR MAXIMUM PRODUCTIVITY,
California Univ., Davis. Dept. of Agronomy.
R. S. Loomis.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 25-30, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program, National Academy of Sciences, Washington, DC, publisher. 2 fig, 5 ref.

Descriptors: *Nitrogen fixation, *Legumes, *Productivity, Crop response, Cereal crops, Biomass.
Identifiers: *Symbionts, *Nitrogen (Industrial), Photosynthates, Resistance (Nitrogen), Ratios (Nitrogen:Carbon).

Maximizing the production of photosynthate is not always synonymous with optimizing the output. Canopies capable of a rapid photosynthesis must be coupled with plant types whose biomass consists largely of useful products. A key feature of new cereals is their tolerance to an abundance of nitrogen (N). Symbiotic N-fixation is accomplished at the expenditure of photosynthate and involves a direct drain on productivity, particularly pronounced when low-value legumes are rotated with high-value crops. Industrial nitrogen and nonsymbiotic N-fixation do not tax the energy material within the produced crops. (See W70-00277). (Wilde-Wisconsin)
W70-00281

SIGNIFICANCE OF THE NITRIFICATION REACTION IN NITROGEN BALANCES,
Tennesse Valley Authority, Muscle Shoals, Ala.; and Iowa State Univ., Ames. Dept. of Agronomy.
R. D. Hauck, and J. M. Bremner.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 31-39, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 10 ref.

Descriptors: *Nitrification, *Nitrogen cycle, Volatility, Denitrification, Leaching, Fertilizers, Inhibitors, Coatings.
Identifiers: *Nonphytotoxic chemicals, *Nitrogen loss, *Nitrogen retention, Chemodenitrification, 2-chloro-6-pyridine, 'N-serve', Inhibitors (Nitrification), Fertilizers (Organic).

The volatilization, denitrification, and leaching losses of nitrogen (N) are reduced by the use of fertilizers of limited solubility or biological degradation, such as magnesium ammonium phosphate, crotonylidenediurea, isobutyridenediurea, and ureaforms. The same goal is achieved by coating fertilizers with waxes, paraffins, acrylic resins, vinyl acetate, latex, gums, etc. An increase in the recovery of fertilizer N is sought by employing nonphytotoxic nitrification inhibitors, including thiourea, cyanamide, mercapto compounds, pyridine, and triazine derivatives. Studies indicated that 2-chloro-6- (trichloromethyl)-pyridine reduces the leaching and volatilization losses of fertilizer nitrogen. (See W70-00277). (Wilde-Wisconsin)
W70-00282

NITROGEN STORAGE OF SEVERAL CALIFORNIA FOREST SOIL-VEGETATION SYSTEMS,
California Univ., Berkeley. School of Forestry.
Paul J. Zinke.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 40-53, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 1 fig, 4 tab, 7 ref.

Descriptors: *Biomass, *Nitrogen, *California, *Ecosystems, *Forests, Soils, Precipitation.
Identifiers: *Sierra Nevada (California), Chaparral microforest, Ponderosa pine, Douglas fir, Redwoods, Granite, Andesite, Site index, Forest litter.

Storage of nitrogen (N) was determined in chaparral, mixed coniferous, and redwood ecosystems. The relative level of N-enrichment of either soil or plant tissues was influenced by the nature of vegetative cover. Increase in precipitation augmented the N-content of forest ecosystems. The total amount of N ranged from 200 grams/square meter in the chaparral microforest to 2,750 grams/square meter in redwoods. Mixed conifers showed intermediate values. About 11 percent of N of ecosystem occurred in trees of redwood forests. (See W70-00277). (Wilde-Wisconsin)
W70-00283

THE NITROGEN ECONOMY OF GRASSLAND AND DUNE SOILS,
Oak Ridge National Laboratory, Tenn. Radiation Ecology Section; and Colorado State Univ., Fort Collins. Dept. of Agronomy.
Roger Dahlman, Jerry S. Olson, and Kenneth Doxtader.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 54-82, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 3 fig, 9 tab, 59 ref.

Descriptors: *Nitrogen cycle, *Grasslands, *Ecosystems, Prairie soils, Systems analysis, Model studies.
Identifiers: *Shoot-root turnover, Income-loss balances, Steppe soils, Missouri prairie, Dune soils, Meyer's quotient, Lang's quotient, Transeau's quotient.

A preliminary model of nitrogen (N) cycle for a native grassland ecosystem is presented. Available results suggest that an appreciable fraction of nitrogen is returned in available form by the shoot and root turnover. Mineralized nitrogen from these sources is nearly adequate to satisfy the minimum requirements of higher plants. Because evaluations of nitrogen inventory and microbial transformations are incomplete or inadequately estimated, authors conclude that further progress in systems analysis of N-cycle depends upon completion of field studies bearing on transformations. (See W70-00277). (Wilde-Wisconsin)
W70-00284

EFFECTS OF NITROGEN FROM LEGUMES AND CROP RESIDUES ON SOIL PRODUCTIVITY,
California Univ., Davis. Dept. of Agronomy.
W. A. Williams.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 83-89, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 2 tab, 13 ref.

Descriptors: *Nitrogen, *Nitrogen cycle, *Legumes, *Decomposing organics, *Soil structure, Mineralization, Corn (Fields), Cotton, Crops, Fertilization.
Identifiers: *Crop residues, *Decomposition (Aerobic), *Decomposition (Anaerobic), *Soil fertility, Cowpeas, Nitrogen release, Nitrogen immobilization.

The nitrogen content needed for decomposition of straw under anaerobic conditions is about one-third of that required for decomposition of crop residues in aerobic environment (0.54% versus 1.5%). Rice crop residues in flooded soils are apt to release rather than to immobilize nitrogen during decomposition. High-nitrogen residues which decay very rapidly have a short-lived effect on soil structure and are of little benefit to the crop that follows incorporation. (See W70-00277). (Wilde-Wisconsin)
W70-00285

AN INVESTIGATION OF THE NITROGEN-FIXING ABILITY OF NATIVE CHILEAN RHIZOBIA STRAINS AND SOME PROBLEMS RELATED TO THEIR SYMBIOSIS WITH SEVERAL LEGUMES,
Concepcion Univ. (Chile). Departamento de Microbiologia.
Raul Zemelman.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 90-100, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, Publisher. 5 tab, 18 ref.

Descriptors: *Nitrogen fixation, *Legumes, Symbiosis.
Identifiers: *Phosphorus fixation, *Microbial strains, Trifolium pratense, Trifolium subterraneum, Medicago sativa, Chile, Rhizobium meliloti, Rhizobium trifolii.

Greenhouse and field trials revealed no effective native Chilean strains of Rhizobium meliloti in symbiosis with Medicago sativa. More than 30% of the native strains of Rhizobium trifolii were effective with Trifolium pratense and 11.5% with T subterraneum. More than 300 U/phosphorus pentoxide/hectare (unit of application not defined otherwise in report) were needed for establishment of symbiosis in soils having a high capacity for phosphorus fixation. (See W70-00277). (Wilde-Wisconsin)
W70-00286

INOCULATION OF LEGUMES IN BRAZIL,
Rio Grande do Sul, Porto Alegre (Brazil). Faculdade de Agronomia e Veterinaria.
J. R. Jardim Freire, Carlos F. Goepfert, and Caio Vidor.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 101-113, 1969. Production Processes Subcommittee (E R Lemon, Chairman) US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 3 fig, 6 tab, 12 ref.

Descriptors: *Legumes, *Fertilizers, Trace elements, Sulfur, Nitrogen, Potassium, Phosphorus, Aluminum, Manganese.
Identifiers: *Brazil, *Rhizobium, *Microbial strains, State of Rio Grande do Sul (Brazil), Toxicity (Aluminum), Toxicity (Manganese).

Authors stress the importance of the selection of suitable strains of Rhizobium for nitrogen-fixation and adjustment of soil fertility by application of lime, nitrogen, phosphorus, sulfur, and trace elements. High content of potassium, as well as toxicity of aluminum and manganese, depress the effect of inoculation. (See W70-00277). (Wilde-Wisconsin)
W70-00287

NONSYMBIOTIC NITROGEN FIXATION IN TROPICAL SOILS,
Johanna Dobereiner.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 114-128, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 8 tab, 25 ref.

Descriptors: *Nitrogen fixation, *Tropical regions, *Soils, Azotobacter, Acid soils, Temperature.
Identifiers: *Nitrogen fixation (Nonsymbiotic), *Beijerinckia, Derxia, Azotobacter paspali, Paspalum notatum, Sugar cane, Acid soils (Tropical), Thermal optima, Carbon sources.

Acid tropical soils harbor at least six nonsymbiotic bacteria which have a capacity of fixing from 12 to 30 milligrams of nitrogen (N) per gram of carbon source. The growth-promoting effect of Beijerinckia indica and Azotobacter paspali was particularly pronounced. The rate of N fixation depended on temperature, A paspali and Derzia spp requiring from 33 to 37 deg C. (See W70-00277). (Wilde-Wisconsin)
W70-00288

IMPORTANCE OF NONSYMBIOTIC ORGANISMS IN THE NITROGEN ECONOMY OF TROPICAL SOILS,
Instituto Agronomico, Campinas (Brazil).
Francisco da Costa Verdade.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of Nitrogen, p 129-152, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 4 tab, 128 ref.

Descriptors: *Nitrogen fixation, *Nitrogen cycle, *Tropical regions, *Soils, Leaching, Erosion, Fertilizers, Rain water.
Identifiers: *Nitrogen fixation (Nonsymbiotic), *Beijerinckia, *Soils (Tropical), Sao Paulo State (Brazil), Climate-nitrogen function, Lateritic (Feralitic) soils, Photochemical fixation of N, Rice, Sugar cane, Grasses, Brazil, Nitrogen (Sources), Nitrogen (Crop removal), Terra roxa soils.

In spite of a prolonged cultivation, certain types of terra roxa soils fail to respond to application of nitrogen (N) fertilizers. The author assumes that the consumption of N by crops is compensated by nonsymbiotic N-fixing organisms. A possibility of inoculation with bacteria of the genus Beijerinckia is suggested as a means of increasing the yield of rice, sugar cane, and grasses. (See W70-00277). (Wilde-Wisconsin)
W70-00289

PHYSIOLOGY OF THE SYMBIOSIS BETWEEN RHIZOBIUM AND LEGUMINOUS PLANTS,
Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.
Martin Alexander.
Proceedings of Conference, California Univ, Davis, 28 Nov-1 Dec 1967. Biology and Ecology of

Nitrogen, p 153-156, 1969. Production Processes Subcommittee (E R Lemon, Chairman), US Nat Committee for International Biological Program. National Academy of Sciences, Washington, DC, publisher. 10 ref.

Descriptors: *Physiological ecology, *Legumes, Alfalfa.
Identifiers: *Rhizobium, *Antimetabolites, *Coconut water, *Symbiotic specificity, Alpha-picolinic acid, Alpha methylglutamic acid, Saccharomyces carlsbergensis, Inositol, Niacin, Gum-producing strains, Benzene-hexachloride, Seed extracts (Alfalfa), Growth regulators, Nodulation.

Nodulation of excised roots of alfalfa was enhanced by extracts of alfalfa seed. Coconut water exerted a similar effect on excised roots of several legumes. Purification of coconut water on activated charcoal yielded a fraction effective in the nodulation bioassay test. This fraction of 4000-fold purification appears to be effective at concentrations from 1 to 0.1 parts per million and may be considered as a growth hormone or growth regulator. The antimetabolite alphapicolinic acid prevented nodulation of birdsfoot trefoil, but had no effect on the growth of the plant. Benzene hexachloride and alpha-methylglutamic acid inhibited nodulation of excised bean roots, but not the root development. Pyridine-3-sulfonate increased nodulation of bean plants. These effects are reminiscent of the influence of Saccharomyces carlsbergensis. A streptomycin-resistant, phage-sensitive strain of Rhizobium trifolii was able to survive irradiation, but proved to be nonnodulating. (See W70-00277). (Wilde-Wisconsin)
W70-00290

COMMUNITIES OF OVER 1000 POPULATION WITH WATER CONTAINING IN EXCESS OF 1000 PPM OF TOTAL DISSOLVED SOLIDS.
Black and Veatch, Kansas City, Mo.
For primary bibliographic entry see Field 05F.
W70-00308

2L. Estuaries

A HYDRAULIC MODEL STUDY OF LANDSLIDE-GENERATED WATER WAVES IN BAYS,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08B.
W70-00003

A MATHEMATICAL THEORY ABOUT SAND WAVES AND ITS APPLICATION ON THE DUTCH WADDEN ISLE OF VLIELAND,
Netherlands Rijkswaterstaat, Arnhem. Engineering Dept. of Coastal Research.
For primary bibliographic entry see Field 02J.
W70-00043

URANIUM AND RADIUM IN THE SURFACE LAYER OF OCEANIC SEDIMENTS,
For primary bibliographic entry see Field 02J.
W70-00044

SHORE EROSION OF THE NORTHERN CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.; and Johns Hopkins Univ., Baltimore, Md. Dept. of Oceanography.
For primary bibliographic entry see Field 02J.
W70-00047

THE BALANCE OF SEDIMENTARY MATERIAL IN THE SEA OF AZOV,
Karaganda Polytechnical Inst. (USSR); and Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W70-00051

GEOLOGIC AND GEOGRAPHIC CONTROLS UPON THE RATE OF SOLUTE REMOVAL FROM SELECTED COASTAL RIVER BASINS BETWEEN HALF MOON BAY AND DAVENPORT, CALIFORNIA,
Miami Univ., Oxford, Ohio.
A. Dwight Baldwin, Jr.
Proc 3rd Annu Amer Water Resource Conf, Nov 8-10, 1967, San Francisco, Calif, p 548-562, 1967. 15 p, 10 fig, 8 ref.

Descriptors: *Water quality, *Hydrogeology, *California, Aqueous solutions, Water chemistry, Solutes, Provenance, Geology, Runoff, Groundwater movements.
Identifiers: California Coastal drainage basins.

Water samples from 4 coastal streams between Half Moon Bay and Davenport, California, were collected and analyzed to determine the factors governing the rate of solute erosion. Geologic controls upon the dissolved solids content result from the complex petrology and structural geology in this section of the outer Coast Ranges. Between 35 and 40% of the chloride removed yearly enters the basins as fine dust derived from the zone of breaking surf along the coast. In the San Lorenzo watershed, during the water year 1960-61, mean discharge was only 25.8 cfs. Solute load for this water year was 52.5 tons/sq mi/year. During the water year 1958-59, the solute load rose to 515 owing to an increase in mean discharge to 278 cfs. Results of this study indicate that conditions favorable for a rapid rate of solute erosion are those least favorable for a high rate of suspended solid removal. (Knapp-USGS)
W70-00067

DISPERSION IN FRESH WATER PORTIONS OF ESTUARIES,
Drexel Inst. of Tech., Philadelphia, Pa.; and New York Univ., Bronx, N.Y. Dept. of Civil Engineering.
Michael D. Disko, and Erick R. Gidlund.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 563-577, 1967. 15 p, 8 fig, 6 ref.

Descriptors: *Dispersion, *Estuaries, *Fresh water, Currents (Water), Tides, Water level fluctuation, Path of Pollutants, Diffusion, Streamflow, Tidal effects, Mixing.
Identifiers: Estuarine dispersion.

An analysis of an ideal estuary section, using the principles of conservation of mass and momentum together with relationships between velocity and tidal amplitude, results in an equation which predicts the spatial and temporal behavior of the friction velocity. The friction velocity and, hence, the dispersion vary throughout the tidal cycles. Dispersion reaches a maximum value at high or low water slack and decreases as the mean water depth occurs in the estuary. The experimental verification essentially consisted of a series of measurements of the spread of instantaneous injections of fluorescein dye and saline water in order to determine concentration and dispersion patterns in a model estuary. Results from the experimental program show that the average level of dispersion, initially zero at dye injection, gradually rises over a period of two or more cycles until an equilibrium state is reached. Instantaneous dispersion values in the model, however, follow a cyclical pattern predicted by the above analysis of an ideal estuary section. Also, results show that the higher the tidal range or river inflow into the estuary, the larger the dispersion. (Knapp-USGS)
W70-00068

THE MIXING OF WARM WATER FROM THE USKMOUTH POWER STATIONS IN THE ESTUARY OF THE RIVER USK,
Central Electricity Generating Board, Portishead (England). Research and Development Dept.
For primary bibliographic entry see Field 05C.
W70-00150

CURRENT SYSTEM IN THE NORTHERN IRISH SEA,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
J. W. Ramster, and H. W. Hill.
Nature, Vol 224, No 5214, p 59-61, Oct 1969. 3 p, 5 fig, 1 tab, 5 ref.

Descriptors: *Ocean circulation, Ocean currents, Water circulation, Synoptic analysis, Tides, Tidal effects, Oceanography, Tracers, Tracking techniques, Current meters.
Identifiers: *Irish Sea.

Direct measurements were made of the tidal streams in the northern Irish Sea by tracking seabed drifters released near the Isle of Man. A drift toward the south in the center of the area was determined. Current meters were installed by 5 cruises since 1966 and current data obtained are tabulated and mapped. It is suggested that the main deep flow of the Irish Sea is associated with a deep channel in the northwestern part and does not pass east of the Isle of Man as do the surface currents. (Knapp-USGS)
W70-00202

SALTWATER INTRUSION IN THE UNITED STATES.
For primary bibliographic entry see Field 02F.
W70-00211

WINTER CIRCULATION IN THE GULF OF ALASKA,
Washington Univ., Seattle. Dept. of Oceanography.
Gunnar I. Roden.
J Geophys Res, Vol 74, No 18, p 4523-4534, Aug 20, 1969. 12 p, 8 fig, 23 ref. ONR Contract 477 (37).

Descriptors: *Water circulation, *Alaska, *Winter, *Estuaries, Seasonal, Thermal stratification, Water temperature, Saline water, Velocity, Mass transfer, Eddies, Atmospheric pressure, Winds, Mathematical studies, Density.
Identifiers: *Gulf of Alaska.

The steady-state winter circulation in the Gulf of Alaska was investigated and related to the main thermohaline features of the Gulf. Vertical stratification consists of three principal layers at depths of 100, 200, and over 200 meters respectively. The total mass transport between the surface and the bottom is about 10 million gr/cm/sec. Counterclockwise eddies are found in the semi-enclosed northern part of the Gulf characterized by its westward water transport. Between latitudes 50 deg and 55 deg N, total transports are predominantly westward and represent return flow from eastward transports further south. In general, the velocity structure with depth often shows a maximum in the halocline, providing a mechanism for the formation of warm and cold water cores which are frequently observed in the Gulf of Alaska. (Gabriel-USGS)
W70-00220

THE CHANNELIZED FLOW OF TURBIDITY CURRENTS WITH APPLICATION TO MONTEREY DEEP-SEA FAN CHANNEL,
Scripps Institution of Oceanography, La Jolla, Calif.
Paul D. Komar.
Work partly supported by Scripps Inst of Oceanography. J Geophys Res, Vol 74, No 18, p 4544-4558, Aug 20, 1969. 15 p, 9 fig, 2 tab, 21 ref. ONR Contract NONR-2216 (23).

Descriptors: *Turbidity currents, *Channel flow, *Estuaries, *California, Coriolis force, Pressure, Velocity, Density, Friction, Canyons, Mathematical studies, Slopes, Pleistocene epoch, Sedimentation rates, Erosion, Sediment discharge.
Identifiers: *Monterey Channel.

Turbidity currents of the Monterey deep-sea channel were investigated analytically and experimentally by using the Chezy equation and setting up an

equation that balances the centrifugal and Coriolis forces against the pressure force that results from the cross-channel surface slope. This balancing equation was utilized for calculation of average velocity curves versus density, the two variables in the equations, and the two principal unknowns of turbidity current flow. The equations were applied to the fathograms of 12 crossings taken along a 100 km stretch of the channel. The channel velocities vary from 600 to 2000 cm/sec under conditions of permissible densities, values comparable to the velocities obtained from ordered sequences of submarine cable breaks. Using velocities deduced from the level height differences, it is found that a reasonable range of Pleistocene slump volumes in the Monterey Canyon is capable of generating channel-full turbidity currents of adequate length and time of passage. Solution of equations under a wide range of sediment discharge rates indicates no substantial erosion of the channel since the Pleistocene. (Gabriel-USGS)
W70-00223

TIDAL MODEL OF NORTHUMBERLAND STRAIT,
Acres (H. G.) and Co. Ltd., Niagara Falls (Ontario).
James E. Cowley.
ASCE Proc, J Hydraul Div, Vol 95, No HY3, Pap 6551, p 827-838, May 1969. 12 p, 13 fig.

Descriptors: *Tidal effects, *Ocean currents, *Water circulation, *Coastal engineering, *Hydraulic models, Water levels, Bridges, Highways.
Identifiers: *Northumberland Strait (Canada), Prince Edward Island (Canada).

A model was made to study the effects of a proposed highway crossing on the tidal circulation of Northumberland Strait between the mainland and Prince Edward Island, Canada. The model represented an area of about 5,000 sq mi. The small model scale and the scale distortion of 100:1 were corrected with empirically derived adjustments. It was concluded that significant changes in tidal levels, tidal currents, and storm surge heights will be avoided if an opening equal to at least 1/3 of the present flow area of the Strait is incorporated in the crossing. Increases in the range of high- and low-tidal levels will be extensive if the Strait is completely closed by a causeway. Experience in operating the model has demonstrated that modern control and measuring systems can accurately reproduce and record tides in a model with a time scale as great as 800. The model was adequate at these scales for investigation of the gross changes in tide impedance which would result from the erection of partial barriers across the Strait. In common with some highly distorted river models, however, the best calibration of this model was achieved by a departure from the theoretical rules for similitude, indicating that a more moderate scale distortion would be required for studies of more subtle phenomena, such as details of long distance circulations or mixing and dispersion of salinity or pollutants. (Knapp-USGS)
W70-00231

THE NEAR-SHORE SHALLOWS OF WESTERN CUBA AND THEIR SEDIMENTS (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
V. P. Jenkovich.
Russian original with English summary. Okeanologiya, Moscow, USSR, Akad Nauk, Vol 9, Issue 2, p 256-270, Mar-Apr 1969. 15 p, 8 fig, 19 ref.

Descriptors: *Seashores, *Sediments, *Boreholes, Erosion, Sands, Algae, Calcium carbonate, Silts, Forests, Peat, Tides, Currents (Water), Coral, Runoff, Geomorphology, Mapping, Lagoons, Reef, Topography.
Identifiers: *Cuba, Coastal line of Western Cuba.

The coast of Western Cuba was investigated by using geological, hydrological and borehole data recorded by the Soviet-Cuban expedition of 1965. In many places boreholes revealed surfaces of wind erosion at depths up to 13 meters. The study shows that presence of a certain algae species and some chemically-formed calcium carbonate. Peat layers up to 1 m in thickness are present at the edge of the mangrove forest. Strong tidal currents are responsible for the existence of ridge-like relief in sands and silts of Western Cuba. (Gabriel-USGS)
W70-00234

SOME PECULIARITIES OF THE FORMATION OF TIDAL PHENOMENA IN THE SOUTH CHINA SEA (RUSSIAN),
Meteorological Service of the City of Hanoi (North Vietnam).
Nguyen Ngoc Thuy.
Russian original with English summary. Okeanologiya, Moscow, USSR, Akad Nauk, Vol 9, Issue 2, p 235-249, Mar-Apr 1969. 15 p, 9 fig, 2 tab, 25 ref.

Descriptors: *Tidal waters, *Seashores, *Tides, *Estuaries, Electronic equipment, Hydrologic data, Frequency analysis, Energy equation, Mapping, Gaging stations, Hydrodynamics, Friction, Waves (Water), Velocity, Resonance.
Identifiers: *Tidal phenomena, *South China Sea.

A numerical computation of tidal characteristics of the South China Sea was made by using the Hansen method and an electronic computer (BESM-2M), and disregarding the drag effects. The results of the study were plotted on the maps showing the parameters of tides and tidal currents of the South China Sea. In spite of some shortcomings, the results of the study should be considered as more reliable as compared with the similar results of earlier investigations in the same area. The conditions under which the tidal phenomena of the South China Sea are formed and the reason for the existence of large diurnal tidal components are also discussed on the basis of the analysis of resonance phenomena energy, depth, and other pertinent parameters. (Gabriel-USGS)
W70-00235

ON THE NATURE OF THE PERIODICITY OF WAVES ON THE SURFACE OF A NONCOHESIVE MEDIUM (A CRITICAL REVIEW OF THE TURBULENCE HYPOTHESIS),
For primary bibliographic entry see Field 02J.
W70-00252

OBSERVED LARGE-SCALE STRUCTURE OF TURBULENCE IN A RIVER MOUTH,
B. S. Shteynman.
Transl from Okeanologiya, Akad Nauk, SSSR, Vol 8, No 6. Oceanology, Vol 8, No 6, p 768-770, 1968. 3 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Turbulence, *Streams, Vortices, Eddies, Sedimentation, Erosion, Channel morphology, Turbulent flow, Frequency analysis.
Identifiers: Macroturbulence.

Field measurements were made of large-scale turbulence in the mouth of the Kura River. Expressions are given for the autocorrelation function at various distances from the mouth and for the laws which govern the changes of large-scale turbulence along the river stream in the coastal waters. In particular, the sharp damping of helical circulation in the river mouth and the decrease of size of turbulent perturbations seawards are discussed. (Knapp-USGS)
W70-00253

INTERACTION OF DETRITUS WITH HIGH-MOLECULAR-WEIGHT COMPONENTS OF DISSOLVED ORGANIC MATTER IN SEA WATER,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
For primary bibliographic entry see Field 02K.
W70-00258

INVESTIGATION OF QUANTITATIVE DISTRIBUTION OF SUSPENSION IN COASTAL WATERS OF THE WHITE SEA,
Akademiya Nauk SSSR. Institut Okeanologii
V. S. Medvedev, and N. M. Krivonosova.
Transl from Okeanologiya, Akad Nauk, SSSR, Vol 8, No 6. Oceanology, Vol 8, No 6, p 792-803, 1968. 12 p, 10 fig, 13 ref.

Descriptors: *Suspended load, *Bays, Tides, Currents (Water), Turbidity, Erosion, Waves (Water), Beach erosion, Provenance, Sampling, Silts, Clays.
Identifiers: *USSR, *White Sea.

Data on the quantitative content of suspension at 109 stations in Dvina, Onega and Mezen Bays and the northern part of the White Sea are presented. Maps of the distribution of suspensions at the surface and in the bottom layer are compared for rising and falling tide. The structure of flows of suspended sediments and the role of tides in the dynamics of suspended material are analyzed. It is concluded that the origin of suspended material is chiefly abrasive and that it is localized in a comparatively narrow coastal zone. (Knapp-USGS)
W70-00259

MANGANESE AND RELATED ELEMENTS IN THE INTERSTITIAL WATER OF MARINE SEDIMENTS,
California Univ., Los Angeles, Dept of Geology; and California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
B. J. Presley, R. R. Brooks, and I. R. Kaplan.
Science, Vol 158, No 3803, p 906-910, Nov 1967. 1 fig, 2 tab, 18 ref.

Descriptors: *Sediments, *Manganese, *Connate water, Pacific Ocean, California, Iron, Cobalt, Sodium, Diffusion, Oxidation, Reduction (Chemical), Geochemistry, Water chemistry, Oxidation-reduction potential.
Identifiers: *Chemical oceanography, Nickel, Lithium, Enrichment, Nodules (Magnanese), Nodule formation, Deep sea sediments.

Analyses for manganese, nickel, iron, cobalt, sodium, and lithium in the interstitial water of two cores from the California Borderland and six deep-sea cores from the East Pacific Rise showed considerable variation in the concentration of trace elements. Oxidizing near-shore sediments showed marked enrichment in manganese in contrast to sulfide-rich reducing sediments which showed no enrichment when compared to average seawater. Iron and nickel showed the reverse trend. In the deep-sea sediments, concentrations of trace metals were variable, with all except one core showing high enrichments (50-3000 fold) in dissolved manganese, with a maximum concentration of 6.6 parts per million. Nickel and cobalt concentrations followed the same trend, whereas, in near-shore sediments, nickel and iron showed similar patterns; two cores showed 50-fold enrichment in nickel and cobalt. Since concentrations of soluble divalent manganese violated predictions from thermodynamic data, author suggests that solution manganese was present in free as well as in complexed form. Analyses of solid phase of the deep-sea sediments showed manganese to be concentrated in the top layers (0-20 centimeters), apparently supporting the theory of manganese nodule formation in deep-sea sediments by diffusion of manganese from depth to the surface. (Browman-Wisconsin)
W70-00262

THE NITROGEN CYCLE IN THE SEA,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 02K.
W70-00279

STUDIES ON THE BLOOD MORPHOLOGY OF THREE ESTUARINE CYPRINODONTIFORM FISHES,
Federal Water Pollution Control Administration. West Kingston, R.I.
For primary bibliographic entry see Field 05C.

W70-00417

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

BRACKISH WATER PURIFICATION BY BIOLOGICAL FUEL CELL POWERED ELECTRODIALYSIS.
Nebraska Univ., Lincoln.
Wm. A. Scheller, and Carl E. Georgi.
Nebraska Water Resources Research Institute, Technical Completion Report, September 1, 1969. 11 p, 7 tab, 12 ref, append: Biochemical Fuel Cell. OWRR PROJECT No. A-007-NEB.

Descriptors: *Electrodialysis, *Economics, Cost, Brackish, Fresh, Desalination, Nebraska, Water.

Samples obtained from four brackish wells in eastern Nebraska and two NaCl solutions were used in conjunction with a laboratory electrodialysis unit to establish the process parameters necessary for estimating the cost of desalination. Investment and maintenance estimates for a 1000 GPD electrodialysis unit were also obtained. The cost of fresh water (500 ppm total solids) produced from brackish water (980 to 6460 ppm of total solids) was $2.30 to $7.78 per 1000 gallons including a 5 percent cost for investment capital. At a typical rural consumption of 60 gallons per person per day, the above fresh water costs are equivalent to 14 cents to 48 cents per person per day. These figures assume electric power is available at 3.3 cents/kwh, a typical rural Nebraska rate. If the electrodialysis unit were supplied with brackish water from an existing pressurized system and with reduced maintenance costs, the desalinated water costs would be reduced by 57 cents to $1.59 per 1000 gallons, depending on the specific case.
W70-00139

DESALINATION UNDER THE CONDITIONS OF NO WATER DRAINAGE (RUSSIAN),
Tashkent Univ. (USSR).
G. V. Mironicheva.
Akhboroti Izvestiya, Uzbek SSR, Akad Nauk, Issue No 3, p 68-70, 1969. 3 p, 1 ref.

Descriptors: *Leaching, *Saline soils, *Saline water systems, *Drainage water, *Mathematical studies, Soils, Groundwater, Diffusion, Salinity, Porosity, Filtration, Velocity, Water chemistry, Forecasting, Soil chemistry.
Identifiers: Desalination with no drainage.

Desalination of soils with no drainage was investigated by setting and solving a diffusion equation, and using the solution techniques developed by N. N. Verigin, A. Begmatov, and D. F. Shul'gin. Final solutions, obtained by using the Lagrange method, permit the forecasting of salt supply changes in the soil after the end of desalination processes. The analysis of the derived formulas indicates that salt contents increase with depth, and the conclusion is supported by recorded data of soil salinity. (Gabriel-USGS)
W70-00237

CALCULATIONS PERTAINING TO THE DESALINATION OF SALT-CONTAINING FORMATIONS UNDERLAIN BY AN AQUIFER OF GOOD PERMEABILITY (RUSSIAN),
Sredneaziatskii Nauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
R. V. Savel'yeva, and V. A. Baron.
Akhboroti Izvestiya, Uzbek SSR, Akad Nauk, Issue No 3, p 39-43, 1969. 5 p, 1 fig, 7 ref.

Descriptors: *Leaching, *Groundwater movement, *Soil water movement, *Water quality, *Water chemistry, Mathematical studies, Aquifers, Permeability, Climates, Agricultural engineering, Diffusion, Filtration, Sorption, Streamflow, Porosity, Salinity, Estuaries, Rivers, Fourier analysis, Laplaces equation, Forecasting.
Identifiers: Desalination of salt-bearing formations.

Saline and water regimes of soils and grounds of arid regions were analytically investigated to determine the effects of molecular diffusion, sorption, filtration, thermal diffusion, and pressure. By using the equations given by V. V. Rachniskiy (1964), the Laplace transformations, and the Fourier series, the final equation was derived which by knowing the filtration velocity, determines the mineralization of groundwaters in the area under investigation. By knowing the profile of initial soil salinity, the magnitude of filtration stream, and other parameters (porosity, diffusion, water salinity, overburden thickness), the final formula can be utilized for the forecasting of ground salinity regimes. (Gabriel-USGS)
W70-00243

3B. Water Yield Improvement

MANIPULATION OF WATER USE IN AN ASPEN FOREST,
Utah State Univ., Logan. Coll. of Natural Resources.
John D. Schultz, George B. Coltharp, George E. Hart, Jr., and Michael Zan.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 149-159, 1967. 11 p, 3 fig, 1 tab, 13 ref. OWRR Proj A-004-UTAH.

Descriptors: *Water yield improvement, *Utah, *Evapotranspiration control, Forest management, Defoliants, Watershed management, Vegetation.
Identifiers: *Aspen trees.

Aspen forests were treated with sprayed antitranspirant and defoliant to study the possibility of improving watershed yield by evapotranspiration control. Both treatments caused increased runoff yield, and it is concluded that significant changes in the water use budget in Aspen forests can be accomplished. Preliminary data are tabulated and shown by graphs. (Knapp-USGS)
W70-00058

DESIGN OF CLOUD SEEDING PROGRAM,
North American Weather Consultants, Goleta, Calif.
Robert D. Elliott.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR2, Pap 6600, p 275-284, June 1969. 10 p, 6 fig, 3 tab, 2 ref.

Descriptors: *Cloud seeding, *Weather modification, *Network design, *Meteorological data, *Telemetry, Instrumentation, Statistical methods, Irrigation water, Rainfall, Snow management, Streamflow.
Identifiers: Convection band, Experimental design.

Evaluation of the results of cloud seeding in test projects in mountain areas during the winter season would be speeded by the use of a natural mesoscale unit of observation, the convection band. This creates a requirement for real-time telemetry of observations and remote controlled seeding. The use of the natural sub-unit of a winter storm, the convection band, is illustrated by meteorological examples taken from a design study for a Southern Sierra test program. An examination of historical precipitation data showed that with a reasonable assumption as to seeding effects, this method of testing might show statistically significant results in one year; whereas, the conventional seasonal streamflow comparison would require 26 yr, 13 of them seeded and 13 unseeded. Ultimate operational application of these new concepts is explained. (Knapp-USGS)
W70-00230

3C. Use of Water of Impaired Quality

SEA PLANTS FOR FOOD,
Southampton Univ. (England).
J. E. G. Raymont.
The New Scientist, p 10-11, July 18, 1957. 1 fig.

Descriptors: *Marine plants, *Algae, Chlorination, Sodium compounds, Photosynthesis, Carbon dioxide, Nitrates, Phosphates.
Identifiers: *Phaeodactylum, *Gas effluent, Food production, Southampton University.

A marine algae crop of Phaeodactylum has been experimentally grown but not subjected to thorough chemical analysis which would estimate its food value, or protein produced per nutrient intake. The dry weight of the harvested crop was 1/3 gram per liter culture which was a favorable beginning result. Heat sterilization was the preferred procedure in the filtering and sterilizing steps. A commercial ammonium sulfate was used as fertilizer. Algae growth depended on a strong enough light source and was therefore grown in shallow areas and in the winter by artificial lighting. Carbon dioxide for the photosynthesis was supplied as successfully by effluent waste gases of partially purified waste water as by cylinders. The effluent carbon dioxide is hoped to decrease the need for nitrate and phosphate. (Sherman-Vanderbilt)
W70-00161

3D. Conservation in Domestic and Municipal Use

SUNHILL WATER CORP V WATER RESOURCES COMM'N (REVIEW OF WATER RESOURCES COMMISSION GRANT TO SUPPLY WATER).
For primary bibliographic entry see Field 06E.
W70-00103

JOINT OPERATION OF WATER SOURCES.

Ky Rev Stat Ann secs 74.420, 74.430 (1963).

Descriptors: *Kentucky, *Cities, *Water supply, *Operations, Legislation, Water sources, Water resources development, Construction, Water districts, Water users, Legal aspects, Local governments.
Identifiers: Ordinances, Acquisition.

Provisions are made herein for the definition of 'sources of water supply.' Any two or more cities or any two or more water districts organized under this chapter or any combination of such cities and water districts may jointly acquire, by purchase or by construction, sources of water supply and may jointly operate such supply and improve and extend the same. The governing body of any city or water district may adopt a resolution or ordinance determining and electing to acquire and jointly operate sources of supply of water. (Heckerling-Florida)
W70-00276

ORGANIZATION AND GOVERNMENT OF CITIES-THIRD CLASS.

Ky Rev Stat Ann secs 85.140, 85.150 (1963).

Descriptors: *Kentucky, *Rivers, *Sewers, *Navigation, Legislation, Regulation, Drains, Culverts, River regulation, Docks, Cities, Local governments, Administrative agencies, Taxes, Legal aspects.
Identifiers: Ferries.

The common council, by ordinance, establishes and erects public buildings, public ways, sewers, culverts, and gutters, and promotes and regulates navigation on any navigable river within or adjoin-

ing the city. The council licenses, taxes, and regulates ferries across any river within the limits of the city. It also erects wharves, docks, and landings and regulates stationary anchorage and mooring of vessels and rafts. (Moulder-Florida)
W70-00304

JOINT CONSTRUCTION OF WATER SUPPLY.

Ill Ann Stat ch 24, secs 11-126-1, 11-126-3, 11-126-4 (Smith-Hurd 1962).

Descriptors: *Illinois, *Water works, *Water supply, *Reservoirs, Legislation, Legal aspects, Cities, Construction, Maintenance, Contracts, Condemnation, Streams, Water pollution, Jurisdiction, Regulation, Impounded waters, Water sources, Local governments, Pollution abatement, Water pollution control.

Cities may provide a water supply for fire protection and for use by inhabitants by: (1) construction and maintenance of a waterworks system; (2) joint construction of such a system with an adjacent city; (3) procurement of a supply of water from an adjacent city with an existing waterworks system. There is provision for the letting of contracts for the construction of waterworks systems. Cities may acquire property outside their corporate limits for the purpose of constructing, maintaining, or supplying a system of waterworks; similarly, city jurisdiction is extended ten miles beyond its corporate limits for the purpose of preventing pollution or injury to the source of water for the supply of the waterworks. The authorities of each city may make and enforce rules and regulations necessary in the construction and management of its waterworks system and for the use of water supplied thereby. City authorities may also make and enforce regulations necessary for the improvement, care, and protection from pollution of the city's water supply source. The city may charge its inhabitants for water supplied them from the waterworks system. (Keith-Florida)
W70-00371

SOIL AND WATER CONSERVATION DISTRICTS LAW.
Ill Ann Stat Ch 5, secs 106-138.2 (Smith-Hurd 1966).

Descriptors: *Illinois, *Water policy, *Water resources, *Water resource development, Natural resources, Conservation, Legislation, Regulation, Administration, Management, Administrative agencies, State governments, Water, Water conservation, Flood control, Floodwater, Project planning, Recreation.

The Illinois Soil and Water Conservation Districts Advisory Board is established and its organization, powers and duties are delineated. Regulations pertaining to the creation of soil and water conservation districts including petition, notice, and hearing provisions as well as necessary Department of Agriculture findings and determinations are set forth. The Department determines whether the operation of the proposed district is administratively practical. Provisions for a district governing body are set forth and powers of the various districts and their directors, including development and publication of conservation plans and erosion control measures, acquisition of property, cooperation with individuals and government agencies, and powers of suit, are enumerated. Adoption of land use regulations, district consolidation and division regulations, and regutory provisions for formation of subdistricts and district discontinuance provisions are set forth. (Moulder-Florida)
W70-00403

CONSERVATION PERUSE PROGRESS THROUGH EXPLOITATION,
California Tomorrow, San Francisco, Calif.
Samuel E. Wood.
In Planning 1968, Selected Papers from the ASPO National Planning Conference, San Francisco, p 270-277, May 4-9, 1968. 8 p.

Descriptors: *Conservation, *Natural resources, Economic impact, Technology, Natural resources, Government, Pricing, Population, Pollution, Rivers, Lakes, Pesticides, Government subsidies, Federal government, State government, Local government.
Identifiers: *Economic development, Capital improvement.

The article is concerned with the apparent dichotomy of conservation and economic development. Much of the blame for the current state of resource destruction is placed on the city and county governments. The author suggests that the relative state, local and federal responsibility for resource conservation needs a review. The author feels all federal grants and capital improvement programs should be conditioned on area-wide planning and administration. The federal government should also encourage the states into assuming more meaningful responsibilities for protecting the environment. In addition, the federal government should realign its various programs to effectuate development of sound urban units and electronic-data processing should be fully enlisted in resource conservation. Since water resources often enter conservation issues and problems, this article has relevance to water research dealing with institutional and governmental relations. (Murphy-Rutgers)
W70-00415

3E. Conservation in Industry

PROSPECTING AND DEVELOPMENT OF RIVER BEDS, LAKE BEDS AND SHORE LANDS.

Ind Ann Stat sec 46-1620 (1965).

Descriptors: *Indiana, *Oil industry, *Beds under water, *Leases, Legislation, Permits, Land tenure, Oil fields, Land use, Shores, Structures, Natural resources, Beds, Relative rights, Legal aspects, Lake beds, River beds.
Identifiers: *Preferential rights.

When an application for a prospecting permit or lease to river beds, lake beds, and shore lands is made, the owner of the right to prospect for, develop, and produce petroleum from the abutting lands shall have a preferential right to a prospecting permit for a 30 day period after he has received notice of such application. If petroleum has already been discovered in any structure underlying such abutting lands, the owner of the right shall have a lease to the portion of such river bed, lake bed, and shore lands as adjoin such abutting lands upon the terms and conditions herein provided, notwithstanding any acreage limitations herein provided as to permits and leases. (Heckerling-Florida)
W70-00112

SMITH V SPEERS (CONDEMNATION OF PROPERTY FOR CONSERVATION OF ATLANTIC SEA RUN SALMON).

353 A2d 701-705 (Me 1969).

Descriptors: *Maine, *Atlantic salmon, *Fish conservation, *Condemnation, Judicial decisions, Salmonids, Salmon, Anadromous fish, Commercial fish, Conservation, Wildlife conservation, Legal aspects, Administrative agencies, Administration, Fish, Water conservation, Fish management, Fish migration, Flow control, Flow rates, Dams, Hydroelectric plants.

Defendant Commissioner of Inland Fisheries and Game had certain of plaintiff's property, including two hydroelectric dams, condemned for the public purpose of conserving Atlantic sea run salmon. Plaintiff sought a declaratory judgement to determine the validity of the condemnation order alledging among other things that, while the legislature had provided for the conservation of such fish, it had not specifically provided the Commissioner with the power to condemn property for that purpose. The Supreme Judicial Court of Maine, in declaring the taking void, held that because the legislature had not specifically determined that public exigencies require the taking of certain properties for the purpose of regulating the flow of river water for the protection of salmon, the Commissioner had no power to condemn plaintiff's property, and the taking had no effect as to plaintiff and his title in and to the property purportedly taken. (Johnson-Florida)
W70-00188

WATER RIGHTS.
For primary bibliographic entry see Field 04C.
W70-00198

FISH AND WILDLIFE RESOURCES.
Ky Rev Stat Ann secs 150.445-150.991 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Regulation, *Fishing, *Fishing gear, Legislation, Administration, Fish, Rough fish, Minnows, Crayfish, Baits, Electrical shocking gear, Explosives, Fish toxins, Commercial fishing, Sport fishing, Nets, Seines, Recreation, Mussels, Poisons.

Regulations pertaining to the use of commercial and sport fishing gear are set forth. Substances that are injurious to fish and aquatic life are not to be used in fishing. No person may use any electrical device or poison for taking fish. Limits on the number and size of fish taken are delineated. Live bait dealers must obtain a license from the Department of Fish and Wildlife Resources. Musseling operations may be carried on only after a license has been obtained from the Department. Possession of nets such as gill nets, trammel nets, illegal seines, and other nets not authorized by the commissioner is prohibited. Regulations pertaining to the taking of water fowl in the state are provided. Revenue bonds may be issued to establish public lakes, and the Department of Highways is authorized under certain conditions to construct lakes. 'Pay lakes' are defined and pertinent regulations are provided. (Moulder-Florida)
W70-00199

3F. Conservation in Agriculture

MANIPULATION OF WATER USE IN AN ASPEN FOREST,
Utah State Univ., Logan. Coll. of Natural Resources.
For primary bibliographic entry see Field 03B.
W70-00058

A NEW METHOD OF IRRIGATION,
R. L. McWhorter.
Ga B J, Vol 13, No 1, p 114-116, Aug 1950. 3 p.

Descriptors: *Georgia, *Sprinkler irrigation, *Diversion, *Reasonable use, Irrigation engineering, Legal aspects, Damages, Land tenure, Irrigation, Water utilization, Water conveyance, Water consumption, Water law.
Identifiers: Upper landowner, Lower landowner.

Irrigation, however it is accomplished, is a commercial use, and the riparian proprietor is limited to a reasonable appropriation. In order for a riparian owner in Georgia to irrigate his land and not subject himself to a lawsuit, he must only use a reasonable amount of water and must turn that which is not reasonably used back into the main channel before it passes the land of the proprietor below. With the sprinkler system of irrigation being used more and more it is quite conceivable that the courts will be called upon to rule whether irrigation

is legally the same as diversion. Those who contemplate irrigating their lands should get a written agreement from the person below which in effect grants to the upper proprietor the right to take water in such manner. (Heckerling-Florida)
W70-00090

BIOLOGY AND ECOLOGY OF NITROGEN.
California Univ., Davis.
For primary bibliographic entry see Field 02K.
W70-00277

INPUTS FOR MAXIMUM PRODUCTIVITY,
California Univ., Davis. Dept. of Agronomy.
For primary bibliographic entry see Field 02K.
W70-00281

IMPORTANCE OF NONSYMBIOTIC ORGANISMS IN THE NITROGEN ECONOMY OF TROPICAL SOILS,
Instituto Agronomico, Campinas (Brazil).
For primary bibliographic entry see Field 02K.
W70-00289

EFFECT OF TILE DEPTH, SPACING, AND CROPPING PRACTICES ON DRAIN DISCHARGE,
Ohio Agricultural Research and Development Center, Wooster; and Agricultural Research Service, Columbus, Ohio.
J. R. Hoover, and G. O. Schwab.
Trans Amer Soc Agr Eng, Vol 12, No 1, p 150-152, Jan-Feb 1969. 3 p, 3 fig, 6 tab, 6 ref.

Descriptors: Drainage, *Drainage systems, *Tile drainage, Wheat, Oats, *Tile drains, Drain tiles, Rainfall, *Discharge (Water), Agronomy, Corn (Field), Crops, Agriculture, *Dishcarge measurement, Depth, Percolation, Permeability.
Identifiers: *Tile spacing.

A tile drainage experiment to determine relationships between tile flow and cropping practices, drain depth, and drain spacing was conducted in Ohio from 1951 to 1966. Moisture for crops was supplied by rainfall. Narrow (30-ft) drain spacings resulted in a higher tile discharge than the wider (60-ft) spacing. Long-season crops resulted in lower tile discharge than crops growing actively during a small portion of the growing season. Narrow drain spacings and a long-season previous crop result in a lower soil moisture content throughout the year, promoting proper soil moisture conditions for tillage, planting, and harvesting operations. Timeliness of tillage and harvesting are some benefits of good drainage and long-season crops. A measure of the degree of drainage obtained by a tile system is given by the probability of occurrence of tile flow rates. The probabilities of flow during March, April, and May are useful for designing tile systems because these are the months of highest tile discharge and also the months when the seedbed must be prepared for row crops. (USBR)
W70-00351

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MISSISSIPPI RIVER FLOOD PLAIN INFORMATION, ROCK ISLAND COUNTY, ILLINOIS AND SCOTT AND MUSCATINE COUNTIES, IOWA.
Corps of Engineers, Rock Island, Ill.

Corps Eng Flood Plain Rep, June 1969. 105 p, 37 fig, 15 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *Mississippi River, *Illinois, *Iowa, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Rock Island County (Ill), Scott County (Iowa), Muscatine County (Iowa), Standard project flood, Intermediate regional flood.

Flooding of the Mississippi River, Rock Island County, Illinois, and Scott and Muscatine Counties, Iowa is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability of flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-00001

ROCK RIVER FLOOD PLAIN INFORMATION, ROCK ISLAND COUNTY, ILLINOIS.
Corps of Engineers, Rock Island, Ill.

Corps Eng Flood Plain Rep, June 1969. 67 p, 48 fig, 20 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Illinois flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Mississippi River, Historic flood.
Identifiers: *Rock River (Ill), Standard project flood, Intermediate regional flood.

Flooding of the Rock River, Rock Island County, Illinois is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-00004

FLOOD PLAIN INFORMATION, WOLF RIVER FROM LAKE POYGAN TO SHAWANO, WISCONSIN.
Corps of Engineers, Chicago, Ill.

Corps Eng Flood Plain Rep, Aug 1969. 48 p, 31 fig, 18 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Wisconsin, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Wolf River (Wis), Standard project flood, Intermediate regional flood.

Flooding of the Wolf River, Wisconsin is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-00008

FLOOD PLAIN INFORMATION, FRENCH AND CUSSEWAGO CREEKS, MEADVILLE, PENNSYLVANIA.
Corps of Engineers, Pittsburgh, Pa.

Corps Eng Flood Plain Rep, June 1969. 51 p, 10 fig, 15 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Pennsylvania, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Meadville (Pa), Standard project flood, Intermediate regional flood.

Flooding of French and Cussewago Creeks, Meadville, Pennsylvania is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-00010

DRAINS AND LEVEES AFFECTING HIGHWAYS.
For primary bibliographic entry see Field 04C.
W70-00011

ON THE DISTRIBUTION OF THE FREQUENCY OF RESERVOIR DEFICIT,
City Univ., London (England). Dept. of Civil Engineering.
C. Venetis.
J Hydrol, Vol 8, No 3, p 341-346, July 1969. 6 p, 1 fig, 1 tab, 5 ref.

Descriptors: *Reservoir operation, *Streamflow forecasting, *Water storage, *Probability, Markov processes, Statistical methods, Mathematical models, Distribution.
Identifiers: Reservoir deficit forecasting.

The distribution of the relative frequency of deficit in N years of reservoir operation is examined, treating the reservoir content as a homogeneous, finite Markov chain. This distribution is conditional on the initial state of the system. It is derived from the m-step transition matrices via the waiting and the recurrence time distributions. The theory is applied to a simple numerical example. (Knapp-USGS)
W70-00041

FLOOD PLAIN INFORMATION, WESTFIELD AND LITTLE RIVERS, WESTFIELD, MASSACHUSETTS.
Corps of Engineers, Waltham, Mass.

Corps Eng Flood Plain Rep, June 1969. 64 p, 9 fig, 7 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Massachusetts, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Westfield (Mass), Standard project flood, Intermediate regional flood.

Flooding of the Westfield and Little Rivers, Westfield, Massachusetts is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-00042

MAGNITUDE AND FREQUENCY OF FLOODS IN THE UNITED STATES: PART 2. PACIFIC SLOPE BASINS IN CALIFORNIA - KLAMATH AND SMITH RIVER BASINS AND CENTRAL VALLEY DRAINAGE FROM THE EAST,
Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 02E.
W70-00052

A WATERSHED FLOW MODEL OF STOCHASTIC STRUCTURE,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 02A.
W70-00053

RIPARIAN RIGHTS - REASONABLE USE THEORY.

Ark L Rev, Vol 19, No 2, p 193-194, Summer 1965. 2 p, 5 ref.

Descriptors: *Arkansas, *Riparian rights, *Reasonable use, *Dams, Judicial decisions, Water levels, Rivers, Land tenure, Land use, Remedies, Damages, Riparian land, Bayous, Drainage, Legal aspects, Relative rights.

Plaintiff and defendant, adjoining landowners, operated hunting and fishing enterprises. Defendant constructed three dams which prevented the normal drainage of a bayou onto plaintiff's land. Water entered the bayou from a nearby river when the river reached seventeen feet. However, due to one of the dams, water did enter until the river reached nineteen feet. Plaintiff brought a bill in equity seeking removal of the dam and damages. The chancery court directed removal or lowering of the dam but denied damages. On appeal, defendant was allowed to lower two of the dams. Under these circumstances when one lawful use of water interferes with or detracts from another, an equitable adjustment must be made. The present case clearly commits Arkansas to the reasonable use theory in deciding conflicts of interest between riparian owners. However, because of a paucity of decisions, the court's development of the theory is not extensive. The court in the principal case stated that it would not necessarily adopt all the refinements given the reasonable use theory by decisions of other states and that its interpretations would be developed as occasions arise. (Heckerling-Florida)
W70-00083

NAVIGATIONAL SERVITUDE: AN OLD CONCEPT WITH A NEW LIMITATION,
Robert D. Stein.
Buffalo L Rev, Vol 11, No 2, p 417-423, Winter 1962. 7 p, 43 ref.

Descriptors: *Navigation, *Federal government, *Eminent domain, *Compensation, Judicial decisions, High water mark, Condemnation, Easements, Interstate rivers, Power operation and maintenance, Riparian land, Riparian rights, Value, Land tenure, Land use, Non-navigable waters, United States, Legal aspects.
Identifiers: *Navigational servitudes, *Commerce, *Non-riparian uses, Fast lands.

Under the commerce clause of the Constitution, the federal government has the power of navigational servitude which allows the government to control the navigability of an interstate waterway by regulating its flow. The power of navigational servitude is not a new concept and stems from the early case law giving the government the right to control interstate navigable waterways. There are, however, limitations on the power. It can only be exercised over lands below the high water mark of the stream. If the government takes fast lands or a non-navigable stream, it must use its power of eminent domain and pay the owner just compensation. Recent decisions limit the power under the servitude to the high water water mark. In United States v Virginia Electric and Power Company, 350 U.S. 956 (1956), the government attempted to extend the power of navigational servitude to acquire a flowage easement held by the power company over fast land adjoining a navigable river. The Supreme Court adopted a formula which values the non-riparian uses of the land and then adds a probability factor, the probability of the easement's exercise, to apportion the damages between the fee owners and the easement owner. This case will undoubtedly have a limiting effect on the power of navigational servitude since the court allowed the power company payment for the value of the non-riparian uses of the land, but did not allow the company to be recompensed for the riparian value of the easement. (Heckerling-Florida)
W70-00084

ACCESS BY THE PUBLIC TO A PRIVATE BODY OF WATER FOR RECREATIONAL PURPOSES.

Minn L Rev, Vol 38, p 685-689, 1954. 5 p, 23 ref.

Descriptors: *Minnesota, *Recreation, *Public rights, *Condemnation, Bodies of water, Judicial decisions, Land tenure, Lakes, State governments, Public benefits, Legal aspects, Navigable waters, Prescriptive rights, Hunting, Fishing, Riparian land, Legislation, Land use.
Identifiers: Dedication, Estoppel.

The state of Minnesota petitioned for condemnation of a tract of land adjoining a lake, proceeding under a statute which allowed the state to acquire parking or camping areas adjacent to public waters. The owner of the riparian land contended the lake was not a public body of water. The trial court dismissed the petition and on appeal the dismissal was affirmed. Under Minnesota law, whether or not a body of water is public depends on whether it was navigable when Minnesota entered the Union in 1858. In this case the court indicated that the public might be able to acquire the right to hunt and fish through dedication or possibly through prescription or estoppel even though the lake was not navigable at the time of admission of Minnesota to the Union. Dedication can be implied from certain actions by the owner; however, the cases indicate that the right to hunt or fish cannot be acquired by dedication. Early decisions do not recognize a public right to acquire an interest in realty through prescription. Most jurisdictions now hold that acquiescence by an owner for a period equal to the statute of limitations creates a presumption of either prior dedication or prior condemnation. No decisions have been found which even consider the estoppel aspects of the public right to hunt or fish. The best solution would be a statutory enactment providing that after a period of use by the public, an easement will be presumed to have been dedicated to the public for hunting and fishing. (Heckerling-Florida)
W70-00089

EMINENT DOMAIN - WATERS AND WATERCOURSE'S INTERFERENCE WITH DRAINAGE FROM LAND ON NON-NAVIGABLE TRIBUTARY CAUSED BY GOVERNMENT DAM ON NAVIGABLE RIVER HELD COMPENSABLE UNDER FIFTH AMENDMENT.

Harv L Rev, Vol 61, No 5, p 882-884, May 1948. 3 p.

Descriptors: *Eminent domain, *Drainage, *Compensation, *Navigable waters, Non-navigable waters, Judicial decisions, Dams, Federal government, Damages, Rivers, Tributaries, Construction, Condemnation, Mississippi River, Legal aspects.

Plaintiff's use of his land for farming depended on the drainage of surface and underground waters into a non-navigable stream which emptied into the Mississippi River about a mile below plaintiff's farm. Construction of a dam on the Mississippi by the United States raised the normal water level of the tributary, preventing drainage from plaintiff's land. Plaintiff sued in the Court of Claims on the theory of an implied promise by the United States to pay for private property taken for public use without formal condemnation proceedings. The court held that the injury to plaintiff's land was compensable under the eminent domain clause of the Fifth Amendment. Actions like this must be brought under the Fifth Amendment to recover for the 'taking' of property since the government's sovereign immunity prevents suit in tort. In defining a 'taking,' the courts have been influenced by conflicting desires. On one side there is the feeling that public funds should respond for injuries to individuals by public agencies; on the other side, the courts have tried to avoid discouraging public improvements by burdening them with unpredictable and illimitable liabilities. (Heckerling-Florida)
W70-00092

COUNTY BRIDGE CONSTRUCTION.
For primary bibliographic entry see Field 06E.
W70-00108

TOWNSHIPS AND COUNTY LINE BRIDGES.
For primary bibliographic entry see Field 06E.
W70-00109

SEWERS AND DRAINS IN CITIES AND TOWNS.
For primary bibliographic entry see Field 06E.
W70-00113

INTERSTATE PORT DISTRICT OF ILLINOIS AND INDIANA.
For primary bibliographic entry see Field 06E.
W70-00114

INDIANA PORT COMMISSION.
For primary bibliographic entry see Field 06E.
W70-00116

WATERCOURSES - CANALS - TOLL BRIDGES.
For primary bibliographic entry see Field 06E.
W70-00122

PROTECTION OF LAKES.
Ind Ann Stat secs 27-601 thru 27-659 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Water management (Applied), *Water levels, *Drainage systems, Water loss, Water level fluctuations, Drainage practices, Dams, Dam construction, Lakes, Riparian rights, Riparian water loss, Lake shores, Water pollution, Construction costs, Fresh water, Assessments, Legislation, Legal aspects, Artificial watercourses.
Identifiers: Penalties (Civil).

The protection of water levels of public fresh-water lakes includes restrictions on unauthorized drainage works, dam and levee construction, and interference with fresh-water outlets and spillways of any lake. The application of this act is restricted to natural and artificial fresh-water lakes. The Department of Conservation is given authority for strict control over all drainage works, lake water level stabilization improvements, and sewage disposal facilities. Procedures are available to lake shore land owners, counties, and the Department to petition the courts for leave to make lake and drainage improvements, the costs of which are to be ultimately assessed against the respective petitioners. (See also W70-00124 thru W70-00127). (McDonough-Florida)
W70-00123

WATER LEVEL PROTECTION.

Ind Ann Stat secs 27-601 thru 27-619 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Water management (Applied), *Water levels, *Drainage systems, Dams, Dam construction, Drainage practices, Levees, Bank protection, Lakes, Flood control, Water loss, Riparian rights, Ditches, Spillways, Fresh water, Lake Michigan, Legislation, Legal aspects.
Identifiers: Injunctions (Prohibitory), Penalties (Civil).

The Department of Conservation must approve any drainage works or change or destruction of any bank, dam, or levee that would change the water level of a public fresh-water lake. The construction of any drainage works within one hundred sixty rods of any fresh-water lake is restricted unless a dam is constructed to protect the water level of the lake. It is unlawful to lower more than twelve inches the level of any lake having more than twenty acres. This act does not apply to city water reservoirs, electrical generator water supplies, or to the waters of Lake Michigan. The Department may employ injunctive relief to restrain unauthorized construction or drainage. Violations of this act are a misdemeanor. (See W70-00123). (McDonough-Florida)
W70-00124

WATER LEVEL PROTECTION.

Ind Ann Stat secs 27-620 thru 27-628 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Water management (Applied), *Water level, *Lake shores, Water pollution, Sewage, Excavation, Drainage, Drainage systems, Dams, Spillways, Flood protection, Landfills, Land forming, Lakes, Ditches, Legislation, Legal aspects, Administrative agencies, Regulation, Construction.
Identifiers: Injunctions (Prohibitory).

The Department of Conservation may prohibit the commencement of any project on any public freshwater lake that will affect or is likely to affect a lowering of the water level. Written approval from the Department must be obtained prior to the encroachment on the lake level or shoreline by excavating, filling in, or otherwise changing the size or contour of a lake. The State Board of Health and/or the Stream Pollution Control Board must give written approval for the construction of sewage disposal facilities for housing developments of five or more lots where such a development is a part of any change in shoreline. The Department shall establish the average normal water level of all lakes, erect appropriate monuments designating the normal average water level, and sponsor the construction of dams, spillways, and control works necessary to maintain that level. The natural resources and scenic beauty of Indiana lakes is a public right. Both citizens and the Department may seek injunctive relief to restrain violations of this act. (See W70-00123). (McDonough-Florida)
W70-00125

WATER LEVEL STABILIZATION.

Ind Ann Stat secs 27-629 thru 27-645 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Riparian rights, *Water levels, *Water management (Applied), Riparian water loss, Construction costs, Costs, Assessments, Lakes, Dams, Bids, Water level fluctuations, Drainage, Drainage systems, Water loss, Legislation, Legal aspects, Administrative agencies, Surveys.
Identifiers: Public need.

When at least twenty percent of owners of land abutting upon or within four hundred forty yards of the shore or water line of any lake of ten or more acres, or when the Department of Conservation or board of commissioners of any county in which the lake is located desire to stabilize or raise the lake level, they may petition the appropriate court. The form and content of the petition must follow the requirements of law and allege a public need. If the petition is granted, a surveyor is hired to supervise the improvement and determine appropriate assessments for the costs of the improvement. Objection to the petition or the assessments must be timely filed. Costs and expenses of the improvement shall come out of the county general fund or the general lake improvement fund. (See W70-00123). (McDonough-Florida)
W70-00126

WATER LEVEL PROTECTION (LAKES).

Ind Ann Stat secs 27-646 thru 27-659 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Construction costs, *Drainage systems, *Water levels, Legal aspects, Dam construction, Ditches, Landfills, Land forming, Costs, Riparian rights, Lake shores, Administration, Lakes, Lake Michigan, Assessments, Accretion (Legal aspects), Legislation, Administrative agencies.
Identifiers: Penalties (Civil).

Each county may establish a general lake improvement fund. The surveyor in charge of a lake improvement project must compute the costs of the project, apportion the costs against the land benefited, establish a time for payment of assessment, and publish notice of assessments as liens on the land. Failure of the surveyor to faithfully discharge his duties is a misdemeanor. Petitions for the construction of drainage works within the proscribed distance of a lake may ask that abutting landowners, the Department of Conservation, or the appropriate county participate in the costs of the project. No accretional rights accrue to riparian owners by the lowering of any lake water level by drainage or by extending the shoreline out into the water by filling without the written approval of the Department. The State Board of Health must approve all proposed sewage disposal facilities. Lake Michigan is not affected by this act. (See W70-00123) (McDonough-Florida)
W70-00127

MAINTENANCE OF DAMS, LEVEES AND FLOOD CONTROL WORKS.
For primary bibliographic entry see Field 06E.
W70-00129

RESERVOIR SITES FOR STORAGE OF WATER.
For primary bibliographic entry see Field 06E.
W70-00130

INDIANA DRAINAGE CODE - DRAINAGE BOARDS - POWERS AND DUTIES.
For primary bibliographic entry see Field 06E.
W70-00131

CONSTRUCTION OF DRAINS.
For primary bibliographic entry see Field 06E.
W70-00132

DRAIN IMPROVEMENT.
For primary bibliographic entry see Field 06E.
W70-00133

RIVER IMPROVEMENTS BY THE UNITED STATES.
For primary bibliographic entry see Field 06E.
W70-00134

CONSERVATION DEPARTMENT.
For primary bibliographic entry see Field 06E.
W70-00136

HYDROLOGY OF SMALL DRAINAGE BASINS FOR DEVELOPING HYDRAULIC DESIGN CRITERIA,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 02E.
W70-00137

ARMSTRONG V FRANCIS CORPORATION (REPULSION OF SURPLUS WATER).

20 NJ 320, 120 A2d 4-10 (1955).

Descriptors: *New Jersey, *Repulsion (Legal aspects), *Drainage water, *Reasonable use, Judicial decisions, Riddance (Legal aspects), Surface runoff, Surface waters, Floods, Streamflow, Riparian rights, Percolating water, Natural flow doctrine, Erosion, Flood damage, Diversion, Relative rights, Alteration of flow, Flow augmentation.
Identifiers: Civil law rule.

Plaintiff owned land downstream from defendant. Defendant land developer and contractor caused surface and percolating waters from the developed land to be artificially gathered and discharged into the natural stream. The increase in water flow and the deposit of silt from the greater water volume damaged plaintiff's property. Plaintiff brought an action to compel defendant to pipe this water to a discharge lake below his property. Three rules of liability for the casting of surplus surface water onto the land of another have developed: (1) the common enemy rule allows the landowner unrestricted privilege to rid his land of water; (2) the civil law rule imposes liability on anyone who interferes with the natural flow of water so as to cause damage; (3) the reasonable use rule allows the landowner to make reasonable use of his land even though the flow is altered and causes some harm. The court adopted the last rule and found that the defendant's use of his land was unreasonable when weighed against the harm to plaintiff's property. Defendant was held liable for damages. (Helwig-Florida)
W70-00169

ACCRETION - A NEW SLANT,
Warren M. Salomon.
U Miami L Rev, Vol 17, No 3, p 417-420, Spring 1963. 4 p, 17 ref.

Descriptors: *Florida, *Accretion (Legal aspects), *Land tenure, *Access routes, Judicial decisions, Legal aspects, Beds under water, Gulf of Mexico, Shores, Islands, Boundaries (property), Riparian land, Ownership of beds.

In Ford v.Turner, 142 So 2d 335 (2d D.C.A. Fla. 1962), plaintiff and defendant were owners of adjacent tracts of land on the Gulf of Mexico. The lands were separated by a channel. Over a period of years, plaintiff's land had increased in size, growing out into the Gulf over sovereign land until it extended in front of, but did not touch, defendant's land. The result was that defendant's land was almost completely blocked from the Gulf. The court held that accretions belong to the land to which they are joined, regardless of the fact that they also extend in front of other lands. The law as regards accretions has been settled for a long time. Most courts hold that accretions belong to the owner against whose land they form. Division of accretions is done with an attempt to: (1) keep the same proportional share in the new land that the parties had in the old, and (2) allow each party to retain his access to the water. The court must necessarily give due consideration to the correlative rights of adjoining upland owners. The court in the instant case applied rules of law formerly used only in determining ownership of accretions in rivers, not along the seashore. If the court is correct, ingress and egress rights will now be determined by ownership of the submerged land. (Heckerling-Florida)
W70-00170

GIANT FOOD INC V WASHINGTON-ROCKVILLE INDUSTRIAL PARK INC (DAMAGES FROM DRAINAGE).
For primary bibliographic entry see Field 04C.
W70-00176

TREATIES AND RIGHTS OF TRANSIT ON THE ST LAWRENCE,
H. J. Lawford.
The Canadian Bar Review, Vol 39, No 4, p 577-602, Dec 1961. 26 p, 89 ref.

Descriptors: *Treaties, *International law, *Navigation, *St Lawrence River, St Lawrence Seaway, Great Lakes, Canals, Fishing, Commercial fishing, Transportation, Tariffs, Navigable waters, Navigable rivers, International waters, Legislation, Legal aspects.

Recent announcements indicate that the Canadian government intends to restrict the Great Lakes and St Lawrence coasting trade to vessels of Canadian registry. Current legislation also requires compulsory pilotage on these waters. Such policy statements must be considered in light of Canadian treaty obligations containing national treatment clauses, most-favored nation clauses, and direct grants of navigation and cabotage rights. Treaty provisions concerning freedom of transit on the St Lawrence and Canadian canals and coastal fishing will be seriously impaired if Canada does not intend to respect her international committments. (McDonough-Florida)
W70-00180

EXTENT OF PRIVATE RIGHTS IN NON-NAVIGABLE LAKES,
J. W. Cullis.
U Fla L Rev, Vol 5, No 2, p 166-179, Summer 1962. 14 p, 67 ref.

Descriptors: *Florida, *Riparian rights, *Lakes, *Ownership of beds, Nonnavigable waters, Judicial decisions, Federal government, State governments, Legal aspects, Beds under water, Land tenure, Water users, Public lands, Grants, Navigable waters, Riparian land, Overlying proprietor, Relative rights, Riparian waters, Water utilization.
Identifiers: Common law, Civil law.

With the discovery of oil deposits, title to subaqueous property is growing in importance to landowners whose property borders on lakes. In Florida any determination of the rights to waters or submerged lands depends on the question of navigability. If a lake is 'navigable' under the federal definition of the term, then the bed of the lake is held to have passed to the state on its admission to the Union and the state holds the bed in public trust. If a lake is nonnavigable, the bed may pass freely to private owners. Where land bordering a nonnavigable lake is deeded by the state or federal government, state law determines whether the grant carries title out to the center of the lake. The Florida courts will probably follow the majority view and permit private ownership of submerged land to the center of the lake. As yet the Florida courts have not determined the extent to which a bed owner has the right to use the lake overlying his land. Under the common law he may use only immediately overlying his fee; however, under the civil law approach he may use the entire surface of the lake as long as he does not unduly interfere with the rights of the other proprietors. When the question does arise before the Florida courts, adoption of the civil law view will best serve the interests of Florida. (Heckerling-Florida)
W70-00182

RIPARIAN RIGHTS IN GEORGIA,
William H. Agnor.
Ga B J, Vol 18, No 4, p 401-414, May 1956. 14 p, 54 ref.

Descriptors: *Georgia, *Riparian rights, *Reasonable use, *Non-navigable waters, Prior appropriation, Natural flow doctrine, Alteration of flow, Competing uses, Diversion, Industrial water, Irrigation, Irrigation water, Legal aspects, Municipal water, Natural use, Obstruction to flow, Riparian waters, Water pollution, Legislation, Water policy, Permits, Relative rights.

This consideration of the present status of the law regarding riparian rights in non-navigable streams is based on a review of all of the case and statutory material in Georgia. Emphasis is placed on the right of riparian owners to use the water of streams. Generally, each riparian owner is entitled to a reasonable use of such water so long as this use does not adversely affect the natural course of the stream or the rights of other riparian owners. The varying circumstances in each case are used to determine what use is reasonable. Three theories of water law are discussed: (1) the doctrine of riparian rights; (2) the doctrine of prior appropriation; and (3) reasonable use. Each of these theories has its strengths and weaknesses in relation to the three pressing problems of water law. They are: (1) pollution; (2) use of water for irrigation; and (3) use of water by industry and municipalities. The author believes that the present doctrine of riparian rights in Georgia can be adequately modified to meet these problems and makes basic suggestions as to how this can be accomplished. (Schram-Florida)
W70-00183

FLOOD CONTROL AND WATER USAGE.
Ky Rev Stat Ann secs 104.020-104.160 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Flood control, *Flood protection, *Control structures, Legislation, R regulation, Administration, Floods, Flood routing, Dikes, Floodgates, Levees, Water control, Dams, Diversion, Diversion structures, Flood proofing, Operation and maintenance, Financing, Legal aspects, Administrative agencies, Cities, Local governments.

Regulations concerning the power of cities to establish flood control systems and to acquire property for same together with provisions concerning which administrative agency will control the flood control system, payment of expenses, and condemnation provisions are set forth. Certain aspects of the cost of the flood control system may be paid for out of bond revenue. Benefited property shall be assessed to support the operation and maintenance fund. Provisions for collection of delinquent assessments and court review are included. (Moulder-Florida)
W70-00189

NAVIGABLE WATERWAYS.
Ind Ann Stat secs 68-101 thru 68-109 (1961).

Descriptors: *Indiana, *Streams, *Navigation, *Obstruction to flow, Legislation, Legal aspects, Administrative agencies, Riparian rights, Beds, Piers, Docks, Mills, Dams, Aqueducts, Bridges, Barriers, Public benefits, Navigable waters, Navigable rivers, Surface waters, Riparian waters.
Identifiers: *Navigable watercourses, Penalties (Criminal).

Boards of county commissioners may declare any watercourse within their county a navigable watercourse upon petition of twenty-four freeholders. When a petition is made, the commissioners will have the watercourse examined to ascertain whether the watercourse is navigable and of public utility; if so, the watercourse is declared navigable. Twice yearly navigable watercourses are cleared of obstructions under the supervision of the road district supervisor for the district in which the stream is located. Penalties are provided for the obstruction of navigable watercourses. Riparian owners may build structures into navigable watercourses, but not so far out as to obstruct navigation. Mills, dams, aqueducts, viaducts, bridges, and machinery on watercourses will not be affected by designation of the watercourse as navigable. Persons living on or owning property along any watercourse that is navigable for large boats are authorized to hang gates at or near the top of the bank, or across any road leading down the bank and terminating at such watercourse, except within the limits of towns and cities. The Kankakee River is declared a navigable stream. (Keith-Florida)
W70-00191

CHICAGO REGIONAL PORT COMMISSION.

Ind Ann Stat secs 68-301 thru 68-305 (1961).

Descriptors: *Port authorities, *Lake Michigan, *Indiana, *Illinois, Interstate commissions, Great Lakes region, Multiple-purpose projects, Resource development, Navigation, Optimum development plans, Feasibility studies, Transportation, State governments, Programs, Harbors.
Identifiers: Chicago.

The Chicago regional port commission was established to investigate and report upon the feasibility of establishing a permanent interstate port authority within the metropolitan district embraced by the Lake Michigan shore line, with recommendations as to membership of the governing body, proposed method of appointment, duties and powers, jurisdiction, and probable expenses involved in maintenance of such port authority. In addition, the commission was given the authority to study, prepare information, and make recommendations with the ultimate goal of bringing into existence a full development of said district's water transportation facilities so as to lead to a revival of said district as a center of water transportation in realization of the natural advantages of this community. Fifteen thousand dollars was appropriated to pay expenses incurred by the commission. This was to be used to pay the actual expenses of the commissioners and pay for the employment of necessary engineering, legal, and clerical assistants. This act was to take force only upon the passage of equal appropriations by the state of Illinois. (Schram-Florida)
W70-00192

PORT AUTHORITIES.

Ind Ann Stat secs 68-1001 thru 68-1020 (1961), as amended, (Supp 1968).

Descriptors: *Indiana, *Port authorities, *Construction, *Channel improvement, Lakes, Harbors, Construction costs, Bulkheads, Transportation, Inland waterways, Financing, Costs, Taxes, Eminent domain, Right-of-way, Contracts, Bids, Legal aspects, Water law, Legislation, Local governments, Cities, Navigation, Planning, St. Lawrence Seaway.

This is an emergency measure to permit the prompt organization of port authorities to take advantage of the St. Lawrence Seaway project. Municipalities, counties, or both may create port authorities having jurisdiction in all territories of the creating subdivision. Prior to the taking of any municipality's property, a county seeking to create a port authority must compensate the municipality in full in an amount equal to the waterfront investments of such municipality. The port authority is governed by a board of directors. The powers of the port authority include the power to: (1) purchase, construct, sell, lease, and operate docks, warehouses, and other port facilities; (2) improve channels, rivers, and streams necessary to the port; (3) acquire real or personal property; (4) recommend the issuing of revenue bonds to cover costs; (5) sell, lease, or contract for natural or mineral resources of land owned by the port authority; and (6) exercise the rights of eminent domain, right-of-way, easements, and others. The construction and use of port facilities by private enterprise is encouraged. A channel maintenance fund financed by ad valorem taxes of real and personal property may be established upon the approval of the State Tax Commission. (McDonough-Florida)
W70-00194

DAMS AND OBSTRUCTIONS - PROTECTION OF FISH.
Ind Ann Stat secs 11-11-1 thru 11-1112 (1956).

Descriptors: *Indiana, *Dams, *Obstruction to flow, *Fish conservation, Legislation, Legal aspects, Rivers, Streams, Ponds, Reservoirs, Lakes, Fish stocking, Fishing, Cities, Impounded waters, Canals, Outlets, Investigations, Administrative agencies, Regulation, Illinois, Ohio River, Weirs, Nets, Pumps, Lake Michigan, Flow control, Flow, Administration, Fish, Fish management, Water policy, Water conservation.

Identifiers. *Public use, *Natural waterbodies, Penalties (Criminal), Wabash River.

Any person owning, operating or controlling any dam or other obstruction across any watercourse in the state must permit a flow of water through same sufficient to maintain fish in the watercourse below such dam or other obstruction; such persons must also keep a sufficient amount of water in the pond, reservoir, or lake above such dam or other obstruction to maintain fish. The provisions of this act do not apply to water impounded for municipal uses or to the Ohio and specified portions of the Wabash Rivers. Persons violating this act are subject to criminal penalties. It is the duty of the Conservation Department to make appropriate investigations persuant to their power to enforce and administer the provisions of this act. The conservation department may construct and maintain weirs and nets in natural bodies of water to insure that game fish liberated therein will not escape to water not open to the public for fishing. All pumps and machinery used to pump water out of Lake Michigan must be designed so as to prevent the killing of fish. (Keith-Florida)
W70-00195

LEVEE AUTHORITY DISTRICTS.

Ind Ann Stat secs 27-1001 thru 27-1033 (1960).

Descriptors: *Indiana, *Flood control, *Administrative agencies, *Levees, Flood protection, Water control, Drainage districts, Drainage, Local governments, Planning, Financing, Construction, Eminent domain, Legal aspects, Dams, Ditches, Easements, Legislation, Taxes, Dikes.
Identifiers: Penalties (Criminal).

Cities within counties of a specified population range may establish Levee Authority Districts for the purpose of acquiring land and easements upon which to construct, improve, maintain, and regulate levees. Each Levee Authority District is governed by a board having executive and legislative powers for the District. Board members may not hold appointive office, be employed by the District, or have an interest in any contract with or claim against the district. The board may: (1) propose and adopt ordinances; (2) sue and be sued; (3) adopt an annual budget and levy taxes; (4) incur debts; (5) adopt rules and regulations; (6) acquire realty and personalty; (7) sell any unneeded property; (8) construct, maintain and repair levees, dikes, break waters, pumping stations, flood gages, sewers, ditches, and diversion channels as necessary; (9) enter into contracts; (10) exercise the power of eminent domain; and (11) issue general obligation bonds of the district. The construction and operation of levees under this act is declared to be a governmental function of general public necessity. Violations of this act or of regulations and ordinances enacted pursuant thereto are misdemeanor. (McDonough-Florida)
W70-00197

FLOOD CONTROL SYSTEMS.

Ky Rev Stat Ann secs 104.200-104.380 (1963).

Descriptors: *Kentucky, *Financing, *Flood control, *Cities, Costs, Legislation, Regulation, Administration, Flood protection, Dams, Drains, Dikes, Levees, Water control, Diversion structures, Control structures, Economic feasibility.

All fourth class cities may establish a flood control system. The city may acquire necessary land within or without the city by gift, purchase, or condemnation. The city may secure funds by the issuance of bonds payable from the proceeds of an annual property tax and from special assessments. The method of establishing the system, including resolutions, hearings, objections or protests, and adoption of the final ordinance setting up the system is set forth. The system may be constructed by contract or by the city itself. (Moulder-Florida)
W70-00200

INVESTIGATION OF BRAHMAPUTRA RIVER,
East Pakistan Water and Power Development Authority, Dacca. Water Investigation.
For primary bibliographic entry see Field 02E.
W70-00219

DRAINAGE IMPROVEMENT DISTRICTS; REMOVAL OF STREAM OBSTRUCTIONS.

Ill Ann Stat ch 24, secs 11-111-1 thru 11-111-10, 11-111.1-1 (Smith-Hurd 1962).

Descriptors: *Illinois, *Surface drainage, *Drainage engineering, *Obstruction to flow, Legislation, Legal aspects, Drainage districts, Drainage, Cities, Overflow, Rivers, Public health, Taxes, Assessments, Surveys, Construction, Structures, Embankments, Levees, Dikes, Natural streams, Flood protection, Financing, Watercourses, Landfills, Grading, Environmental sanitation, Standing waters.

When a city is wholly or partially subject to overflow and wholly or partially surrounded by levees, dikes, or embankments, to prevent overflow it may: (1) divide the city into improvement districts; (2) fix the grade of the streets or public grounds at any height deemed necessary to give a surface drainage to the river which causes the overflow; and (3) require low lots, blocks, or parts thereof to be filled in such a manner as to prevent water from standing thereon and thus to prevent them from becoming a nuisance or injuriouis to the public health. Methods of survey for cost estimates of necessary construction and of financing are specifically set out. City authorities may remove any obstructions from natural and other watercourses which cause the flooding of any part of the city, regardless of where such obstructions are located. (Keith-Florida)
W70-00225

PEAT AND MUCK DRAINAGE PROBLEMS,
Agricultural Research Service, Athens, Ga. Southeast Watershed Research Center.
John C. Stephens.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR2, Pap 6603, p 285-305, June 1969. 21 p, 13 fig, 23 ref.

Descriptors: *Droughts, *Drainage, *Drying, *Peat, *Muck soils, *Florida, Ecology, Conservation, Swamps, Subsidence, Organic soils, Dehydration, Oxidation, Burning, Land subsidence, Water table, Water level fluctuations, Erosion.
Identifiers: *Everglades.

Drainage of organic soils results in lowering of the surface (subsidence) by shrinkage due to drying, loss of the buoyant force of groundwater, compaction, wind erosion, burning, and biochemical oxidation. The relative effect of each of these factors depends on soil origin, land-management practices, and climate. The total subsidence rate is proportionate to depth of drainage--the lower the water table, the greater the soil loss. In the Florida Everglades the largest losses have been due to biochemical oxidation. With continued subsidence these organic soils will be too shallow for agriculture by the year 2000. Here, drainage has permitted sea water to move inland contaminate the Biscayne aquifer, and has also changed the original ecology of the Everglades area to the detriment of wildlife. Recent water-management programs (1945-68) have ameliorated the consequences of overdrainage. Subsidence of organic soils with drainage occurs worldwide with observed rates up to 3 inches annually. To obtain maximum use of organic soils, drain only those lands that are potentially arable, place drained lands into productive use quickly, and hold water tables as high as crop and human requirements permit. (Knapp-USGS)
W70-00229

MILLS AND MILL DAMS.

Ark Stat Ann secs 35-501 thru 35-526 (1962).

Descriptors: *Mill dams, *Riparian rights, *Flood damage, *Arkansas, Dams, Structures, Mills, Dam construction, Legislation, Damages, Damsites, Fish barriers, Alteration of flow, Canals, Conveyance structures, Overflow, Navigable waters, Engineering structures, Maximum probable flood, Relative rights, Legal aspects, Adjudication procedure.

Any person may erect a dam across a non-navigable watercourse if he owns the land through which such watercourse runs. If water is likely to overflow onto another's land, the person proposing to erect the dam must petition the circuit court for authorization. A jury examines the site and finds estimated damage, type of property that will be inundated, obstructions to fish and navigation, and dangers to health that might ensue. If the builder owns only one side of the stream, he must follow similar proceedings. In addition, he must compensate the owner of land on the opposite side for the equivalent value of one acre of land. This value is determined by the viewing jury. Property-owners subject to damage and the opposite landowner must appear before the court, which considers their testimony together with the inquest returned by the jury in passing on the petition. The order is conditioned upon making provisions for fish passage, payment of damages and valuations, and immediate commencement of work. If the dam is damaged, repairs must be made within three years. The inquest does not bar unforseen damages, and double damages are recoverable if provisions of this act are violated. Similar procedures are followed for cutting a canal through another's property. (Douberley-Florida)
W70-00245

THE CONTROL OF WATER WEEDS.
Agricultural Research Council, Kidlington (England). Weed Research Organization.
For primary bibliographic entry see Field 05G.
W70-00269

COUNTY LINE BRIDGES.

Ind Ann Stat secs 36-2001, 36-2002 (1949).

Descriptors: *Indiana, *Bridge construction, *Local governments, *Boundaries (Property), Bridges, Repairing, Streams, Legislation, Cost repayment, Construction, Cost allocation, Construction costs, Public benefits.

When public convenience shall require the erection, repair, or purchase of any bridge across a stream forming the boundary-line between two or more counties, the board of commissioners of either county may declare its willingness to aid in such improvement. Whenever the other county or counties' board of commissioners declare a like willingness, such improvement may be begun by agreement between the counties. If any county refuses to aid in such improvements, then the improvements may be made by the willing county alone if in its opinion the public convenience requires it. If the cost of such bridge or repairs does not exceed $10,000, the county making such improvements may recover the amount which the benefited county should have paid had it joined in the improvements. Each county shall be regarded as owner of an interest in any bridge provided for in this section and shall have a voice in regulating the use thereof. (Smith-Florida)
W70-00336

EFFECT OF TILE DEPTH, SPACING, AND CROPPING PRACTICES ON DRAIN DISCHARGE,
Ohio Agricultural Research and Development Center, Wooster; and Agricultural Research Service, Columbus, Ohio.
For primary bibliographic entry see Field 03F.
W70-00351

TOWNSHIP LINE BRIDGES.

Ind Ann Stat secs 36-2201 thru 36-2220 (1949).

Descriptors: *Indiana, *Bridge constuction, *Local governments, *Boundaries (Property), Cities, Bridges, Streams, Legislation.

Upon petition of twenty-five freeholders of any township asking the board of commissioners of the county to allow the township to aid another township in contructing a bridge across a stream which forms the boundary between the townships, an election shall be held to determine whether or not an appropriation shall be made for such construction. If a majority of the votes in each township are cast in favor of the bridge construction, the board of commissioners shall levy a special tax and begin construction. If one of the boards of commissioners fails to act, then the other county may construct the bridge alone and assert a claim against the delinquent county. (Smith-Florida)
W70-00354

BRIDGES OVER CANALS.
Ind Ann Stat secs 36-2301 thru 36-2309 (1949).

Descriptors: *Indiana, *Bridges, *Canals, *Highways, Bridge construction, Local governments, Legislation, Repairing, Legal aspects.

Whenever any canal company is required by law to build or repair any bridge where such canal crosses any public road or street, the boards of commissioners have a duty to bring suit against such company for failure to construct or repair such bridge. When any canal company's charter requires it to build a bridge for a highway constructed across the canal, then the state highway commissioner shall require that such construction be made. Upon default of the canal company, the commissioner shall proceed to construct the bridge and charge the costs to the canal company. (Smith-Florida).
W70-00355

LEVEE CONSTRUCTION AND MAINTENANCE.
Ind Ann Stat secs 48-4601 thru 48-4604 (1963), as amended, (Supp 1968).

Descriptors: *Indiana, *Levees, *Flood control, *Construction, Legislation, Legal aspects, Administrative agencies, Maintenance, Surveys, Contracts, Right-of-way, Taxes, Cities, Jurisdiction, Eminent domain, Flood control, Flood protection, Financing.
Identifiers: Cost estimates.

When the Board of Public Works of certain specified classes of cities is of the opinion that the construction, maintenance, repair, or improvement of any levee is necessary for the protection of the city, such Board may cause surveys and estimates of the cost thereof to be made. Methods of financing, letting contracts, and acquiring lands for the construction or maintenance of levees are specifically provided. For purposes of this act the term 'city' includes towns and the term 'Board' includes any municipal department of a city which performs the duties of a Board of Public Works. The Board of a city may appropriate land to construct a levee for the purpose of flood prevention, and it may simultaneously plan for the construction of a street thereon. (Keith-Florida)
W70-00367

INTERSTATE BRIDGES.

Ind Ann Stat secs 36-2401 thru 36-2469 (1949), as amended, (Supp 1968).

Descriptors: *Indiana, *Bridge construction, *Administration agencies, *Interstate rivers, Legislation, Taxes, Costs, Operating costs, Rivers, Streams, Condemnation, Construction, Operation and maintenance, State governments, Highways, Construction costs, Tax rate, Contracts, Interstate commissions, Interstate compacts, Bridges, Interstate, Cities, Railroads, Financing.
Identifiers: *Interstate bridges, Tolls.

Indiana counties and municipalities bordering on state-line rivers or streams are authorized to cooperate with subordinate divisions of adjoining states in building and maintaining bridges across such waters and to pay one-half the expenses thereof. The act includes provisions for: (1) petitioning, levying of taxes, bonding, and appropriation; (2) creating county bridge commissions; (3) creating temporary and permanent joint commissions formed with commissions of another state; (4) purchasing and condemning lands and rights; (5) changing the location of obstructions impeding work; (6) operating bridges; (7) tolls; (8) bridge construction and control, by county bridge commissions, independent of the authorities of an adjoining state; and (9) disbursements by bridge commissions. The Indiana State Highway Commission is authorized to construct state-line bridges, and provisions are made for: (1) bridge location; (2) estimation of costs and the issuance of bonds; (3) a tax levy; (4) bridge maintenance; (5) tolls; and (6) interstate contracts. Provision is also made for the purchase of state-line bridges by cities for public aid to corporations erecting such bridges and for the use of such bridges by railroad companies. (Marsee-Florida)
W70-00373

INTERSTATE BRIDGES.

Ind Ann Stat secs 36-2401 thru 36-2410 (1949).

Descriptors: *Indiana, *Bridge construction, *Administrative agencies, *Interstate commissions, Legislation, Contracts, Operation and maintenance, Costs, Streams, Rivers, Construction, State governments, Construction costs, Taxes, Tax rate, Interstate rivers, Interstate compacts, Bridges, Interstate, Financing, Local governments.
Identifiers: *Interstate bridges.

Indiana counties and municipalities bordering on state-line rivers or streams are authorized to cooperate with subordinate divisions of adjoining states in building and maintaining bridges across such waters and to pay one-half the expenses thereof. Such county may, upon petition of resident property holders, levy a property tax for the building and maintaining of such bridges. The board of commissioners of such county is empowered to plan, construct and maintain these bridges and is authorized to appoint a bridge commission. Such commission may, in conjunction with commissions from adjoining states, establish a temporary joint commission with the following duties and powers: (1) to contract; (2) to use and be sued; (3) to elect officers; (4) to establish rules, regulations and by-laws for its conduct; (5) to employ necessary employees; (6) to have plans and specifications for bridge construction and location prepared; (7) to build and equip the entire bridges and approaches thereto; and (8) to map and survey all Indiana land, structures, rights-of-way, easements and other interests, including under water and riparian rights, the acquisition of which may be deemed necessary to construct such bridges. (Marsee-Florida)
W70-00374

INTERSTATE BRIDGES.

Ind Ann Stat secs 36-2411 thru 36-2421 (1949).

Descriptors: *Indiana, *Bridge construction, *Administrative agencies, *Interstate commissions, Interstate rivers, Legislation, Rivers, Streams, Condemnation, Construction, Costs, Contracts, Operation and maintenance, State governments, Construction costs, Interstate compacts, Interstate, Financing.
Identifiers: *Interstate bridges, Tolls.

Temporary joint commissions, formed by Indiana bridge commissions and similar commissions from adjoining states, may purchase such Indiana land interests as shall be necessary to construct interstate bridges. Condemnations shall be had in the name of the Indiana Bridge Commission. The Commission may require the relocation or removal of obstructions impeding bridge construction. Upon completion of the bridges for which they were created, the Indiana and temporary joint commissions shall cease to exist. A permanent joint commission shall be formed with powers and duties: (1) to sue and be sued; (2) to contract; (3) to operate and control such bridges; (4) to pay over excess net earnings from such bridges to the taxing districts of each state; and (5) to regulate rates, charges, and tolls for the use of such bridges. The interstate bridges may be built, paid for, and maintained by Indiana commissions independently of any adjoining state. In such case, the Indiana commission shall be vested with all the powers and duties devolved upon the temporary and permanent joint commissions. Provisions concerning bridge construction bonds are set forth. (Marsee-Florida)
W70-00375

INTERSTATE BRIDGES.

Ind Ann Stat secs 36-2422 thru 36-2455 (1949).

Descriptors: *Indiana, *Bridge construction, *Administrative agencies, *Highways, Legislation, Taxes, Costs, Operating costs, Rivers, Streams, Construction, Operation and maintenance, State governments, Construction costs, Tax rate, Contracts, Interstate, Financing, Regulation, United States, Legal aspects.
Identifiers: *Interstate bridges, Tolls.

The Indiana State Highway Commission is authorized to construct and maintain highway bridges over interstate rivers and streams whenever such bridge or any part thereof, including approaches, will be within Indiana. Such bridge may be constructed at any point, subject to the approval of the proper authorities of the United States, and the Commission may build any necessary part of such bridge within the territorial limits of another state. The Commission is also authorized to negotiate and contract with the adjoining state for the procurement of the right to build, maintain, and operate such bridges. The Commission shall submit an estimate of the cost of such bridge to the auditor of the county where the bridge is to be located, and that county shall issue bonds for such construction as provided herein. The county shall also levy an annual property tax to meet the principal and interest of bonds. Subject to a grant of authority from the United States, the Commission shall charge toll for the use of such bridges and shall fix the rates of such toll. The Commission shall also make rules governing the use of said bridges. (Marsee-Florida)
W70-00376

INTERSTATE BRIDGES.

Ind Ann Stat secs 36-2456 thru 36-2469 (1949), as amended, (Supp 1968).

Descriptors: *Indiana, *Bridge construction, *Administrative agencies, *Interstate rivers, Legislation, Taxes, Costs, Construction costs, Rivers, Streams, Condemnation, Construction, Highways, Contracts, Interstate compacts, Bridges, Cities, Railroads, Financing, Local governments.
Identifiers: *Interstate bridges, Tolls.

The Indiana State Highway Commission may cooperate and contract with adjoining states to provide payment for the construction of interstate bridges. Such payment is not to exceed one-half the cost of construction. Any city of Indiana or an adjoining state may purchase shares of stock in any interstate-bridge company or corporation. Any city holding four-fifths of all shares in such company, and unable to agree with the other share owners on the purchase of the remaining shares, may con-

demn and appropriate such shares for public use. Such bridge shall then become the property of such city. Counties and townships wherein an interstate bridge may be located may take stock in or make donations to corporations erecting such bridges, and cities may guarantee the payment of bonds of any such company. All railroads shall have the right to use any bridge constructed under this act, and terms as to toll and rates shall be set by agreement with the company operating the bridge or by the circuit court. To provide for a cumulative bridge fund, county commissioners, town boards, and city councils may levy a tax on personal and real property. (Marsee-Florida)
W70-00377

ENGINEER FOR LEVEE AND DRAINAGE DISTRICTS.

Iowa Code Ann secs 455.12, 455.17, 455.18 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Engineering, *Project planning, *Drainage districts, Legislation, Legal aspects, Levees, Administrative agencies, Ditches, Drains, Basins, Public benefits, Surveys, Public health, Settling basins.

The board of supervisors shall appoint a disinterested and competent civil engineer who shall give bond to the county for the use of the proposed levee or drainage district. The engineer shall examine the lands described in the petition and any other lands which would be benefited by said improvement or necessary in carrying out the same. He shall locate and survey such ditches, drains, levees, settling basins, and other improvements as will be necessary, practicable, and feasible in carrying out the purposes of the petition and which will be of public benefit or conducive to the public health, convenience, or welfare. The engineer shall make a full written report to the county auditor setting forth the specifics of his plans. (Heckerling-Florida)
W70-00387

RAILWAY CROSSINGS NEAR MISSISSIPPI RIVER.
Iowa Code Ann sec 478.28 (1949).

Descriptors: *Iowa, *Railroads, *Mississippi River, *Shores, Legislation, Legal aspects, High water mark, Construction, Maintenance, Cities, Administrative agencies.

When in the construction of a railway it becomes necessary to cross another railway near the shore of the Mississippi River, each shall be so constructed and maintained at the point of crossing that the respective roadbeds thereof shall be above high water mark in such river, but where the crossing occurs within the limits of any city or town containing six thousand or more inhabitants, the council or other government authorities thereof may establish the crossing grade. (Heckerling-Florida)
W70-00388

SOMERSET VILLA INC V CITY OF LEE'S SUMMIT (APPORTIONMENT OF FLOOD DAMAGES).
436 SW2d 658-666 (Mo 1969).

Descriptors: *Missouri, *Flood damage, *Overflow, *Damages, Jucidical decisions, Floods, Cloudbursts, Rain water, Runoff, Surface runoff, Obstruction to flow, Natural flow, Artificial watercourses, Drainage, Surface drainage, Legal aspects.
Identifiers: *Apportionment of damages.

During a rainstorm, plaintiff's apartment complex was damaged by flooding allegedly caused by the negligence of a nearby shopping center and by the maintenance of a nuisance by the local municipality. The alleged negligence of the shopping center consisted of allowing a diverted drainage watercourse to become fouled with debris, diminishing the flow of natural drainage from the parking lot. The city was charged with negligently and carelessly maintaining its streets and culverts by permitting weeds and debris to obstruct drainage. In accordance with the lower court's instructions, a general verdict was returned against both defendants jointly. On this appeal, the supreme court reversed and remanded the case for a new trial on the grounds that the city and the shopping center could not be held jointly liable for the entire damage. Quoting extensively from Prosser, the court held that a defendant is liable only for such portion of the total flood damage as may be properly attributed to the negligence of his own acts. (Douberley-Florida)
W70-00389

DRAINAGE DISTRICTS EMBRACING PART OR WHOLE OF CITY OR TOWN.

Iowa Code Ann secs 459.1 to 459.12 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Drainage districts, *Cities, Legislation, Drainage systems, Drainage programs, Sewers, Cost-benefit analysis, Cost-benefit ratio, Estimated benefits, Public benefits, Cost allocation, Financing, Assessments, Drainage, Local governments, Legal aspects, Administrative agencies.
Identifiers: Counties.

The board of any county has the same power to establish a drainage district that includes whole or part of a city or town as they have to establish a district outside a city. A district may not be established wholly within the city limits or for sewer purposes. When a city is benefitted by district improvements, the commissioners classify and assess the benefits and serve notice on the city clerk and on the owners of the lots, parcels and railway rights of way assessed. Provisions are made for objections to the assessments. The board or the city council has the same power to issue improvement certificates, drainage bonds, or waivers for benefits to public property as conferred with relation to assessment for benefits to highways. Cities may issue bonds to pay assessments. When all of a city is included in a district and makes up over one-fourth of the district, the city may request that the county relinquish authority and control of the drainage district if drains are needed or used for storm sewer and drainage purposes. The city takes complete control and responsibility for maintenance. (Douberley-Florida)
W70-00390

SENECA PORT DISTRICT.

Ill Ann Stat ch 19, secs 352.14, 354.1-354.4, 364 (Smith-Hurd 1963).

Descriptors: *Illinois, *Administrative agencies, *Navigable waters, *Port authorities, Legislation, Regulation, Riparian rights, Docks, Piers, Bulkheads, Jetties, Bridges, Weirs, Shores, Shorelines, Public rights, Navigation, Water management, Public benefits.
Identifiers: *Penalties (Civil).

Navigable waters are any public waters used or usable for water commerce. The Seneca Port District has the power to issue permits for the following: construction of all wharves, piers, dolphins, booms, weirs, breakwaters, bulkheads, jetties, bridges, or structures over, under, in, or within forty feet of any navigable waters within the district, and the depositing of rock, earth, sand, or other material in said waters. The district is responsible for the prevention or removal of obstructions, the location and establishment of dock and shore lines, and the regulation of navigation and bridges. The district regulates the depositing of refuse or other material near navigable waters. Any structure, fill, or deposit erected or made in any of the public waters within the port district in violation of these regulations is a purpresture and may be abated as such at the expense of the person responsible therefore or modified as the district may direct. (Moulder-Florida)
W70-00393

DRAINS AND LEVEES-CONSERVANCY DISTRICTS.

Ind Ann Stat secs 27-1501 thru 27-1508 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Water conservation, *Water districts, *Administrative agencies, Legislation, Water resources, Water resources development, Water utilization, Water treatment, Wildlife conservation, Water supply, Water policy, Soil conservation, Flood control, Drainage, Waste treatments, Waste disposal, Sewage treatment, Sewage disposal, Recreation facilities, Recreation demand, Federal government, Local governments.

To better meet the serious problems of water management in the state, landowners may organize water conservation districts which have the power to levy taxes and other necessary powers so that maximum beneficial utilization can be made of Indiana's water resources. Districts may be established for: (1) flood prevention and control; (2) improving drainage; (3) irrigation; (4) providing water supply; (5) collecting, treating and disposing of sewage and liquid waste; (6) developing forests, wildlife areas, parks, and recreational facilities; and (7) preventing erosion. These purposes may be accomplished by cooperating with state and federal agencies. Districts may only operate within bounds of the purposes for which they were established, but can add additional purposes by following the procedures provided for the establishment of districts. Cities may be included within a district provided that the majority of freeholders thereof have petitioned to be included. Freeholders desiring the establishment of a district must file a petition with the circuit court of the county containing the most land within the proposed district. Area may be added to a district in the same manner. (Marsee-Florida)
W70-00395

PLANS OF RECLAMATION.
SC Code Ann secs 18-471 thru 18-490, 18-501 thru 18-508, 18-521 thru 18-528 (1962).

Descriptors: *South Carolina, *Land reclamation, *Drainage programs, *Administration, Dikes, Dams, Bridges, Buildings, Eminent domain, Costs, Cost allocation, Cost benefit analysis, Legislation, Reclamation, Roads, Road construction, Drainage districts, Appraisals, Damages, Drainage, Land development, Financing, Loans, Taxes, Administrative agencies, Channeling, Construction.

A plan for reclaiming lands from overflow or damage by water shall be adopted by the board of supervisors of the drainage district, based upon a report from the chief engineer. Three court appointed commissioners shall appraise all lands involved and shall assess the amount of benefit and damage that will accrue to each tract of land. If the costs are found to be excessive, the court shall dissolve the district. The board of supervisors of the drainage district is empowered to finance the administration costs by appropriate taxes and loans. The board may build, excavate, construct, and complete all works needed to maintain the plan of reclamation. In order to effect the plan, the board may: (1) alter any watercourse in any manner; (2) construct and maintain ditches, canals, levees, dykes, dams, bridges, roads, or any other works improvement deemed necessary; (3) remove any fence or building; (4) hold, control, condemn, and acquire any land or water; and (5) construct any hydroelectric plants. If any corporation shall refuse to construct or enlarge its bridge, the board shall proceed to let the work at the corporation's expense. (Smith-Florida)
W70-00396

CONSTRUCTION OF LEVEES AND FLOOD CONTROL PROJECTS.
Ark Stat Ann secs 20-334, 20-336 (1968).

Descriptors: *Arkansas, *Construction, *Flood control, *Eminent domain, Legislation, Land tenure, Cities, Projects, United States, Contracts, Operation and maintenance, Administrative agencies, Railroads, Right-of-way, Condemnation, Damages, Assessments, Legal aspects, Levees, Land use.
Identifiers: Improvements.

Municipal levee and flood control improvement districts may construct and maintain levees and flood control projects under, over, across, and along the waters and lands belonging to the state, along and over public streets and highways, along and across any railroad right-of-way, and on and over any lands belonging to the municipality. The improvement district may enter contracts with the United States for the construction of such levees or flood control projects. The circuit judge of any county shall appoint appraisers to assess damages when private land for such projects is taken by eminent domain. (Heckerling-Florida)
W70-00398

SOIL AND WATER CONSERVATION COMMISSION.

Ark Stat Ann secs 9-118 thru 9-128 (Supp 1967).

Descriptors: *Arkansas, *Administrative agencies, *Water conservation, *Soil conservation, Local governments, Interstate rivers, Interstate compacts, Drainage systems, Irrigation, Flood protection, Legislation, Water supply, Reservoir storage, Industrial water, State governments, Conservation, Flood control, Federal government, Water control.

The Arkansas Soil and Water Conservation Commission assumes the functions and duties of the now abolished Water Conservation Commission and the Water Compact Commission. The Commission also has all the powers and duties of the Arkansas Geological and Conservation Commission that relate to soil conservation and flood control. Among other powers, the Commission has authority to (1) negotiate with adjoining states concerning the protection and use of interstate waters; (2) cooperate with other states' agencies and federal departments to further water and soil conservation and flood protection; (3) cooperate with local organizations and drainage districts in the development and construction of flood control, drainage, and irrigation projects; and (4) cooperate with counties and municipalities in the development of water supply and storage facilities for consumption and industrial use. (McDonough-Florida)
W70-00404

FLOOD PREVENTION.
Ind Ann Stat secs 48-4901 thru 48-4952 (1963), as amended, (Supp 1968).

Descriptors: *Indiana, *Flood control, *Local governments, *Flooding, Flood plain zoning, Flood protection, Levees, Dikes, Streams, Eminent domain, River training, Obstruction to flow, Barriers, Bridges, Costs, Cost-benefit ratio, Cost allocation, Cost sharing, Alteration of flow, Channelling, Construction, Bridge construction, Legislation.

When any street of any city is subject to flooding by a stream bordering upon or running through such city, and when such flooding may be lessened or prevented by altering or changing such stream, construction or enlargement of dykes or levees, removal of obstructions or encroachments on such stream, or the elevation of any bridge, then such city may petition the circuit court in that county to have such corrective action taken. The court shall determine who shall bear the expenses and may appoint two appraisers to apportion the costs among the parties according to the portion of benefit received. Any dissatisfied party may appeal. Any city may seek to have any proposed bridge construction enjoined if flooding may result from such bridge. Any city may petition the circuit court for the creation of flood control districts. Each flood control board is authorized to perform all acts necessary to carry out the purposes stated in the court's decree. Such board's powers shall include the power of eminent domain. (Smith-Florida)
W70-00405

ACQUISITION OF STATE LANDS BY THE FEDERAL GOVERNMENT.
Ark Stat Ann secs 10-1101, 10-1103, 10-1105, 10-1107, 10-1111 (1958), as amended, (Supp 1967).

Descriptors: *Arkansas, *Flood control, *Land use, *Federal government, Migratory birds, Conservation, National wildlife refuges, Irrigation, Fish hatcheries, Hydroelectric plants, Dams, Legislation, Public lands, Watershed management, Channel improvement, Land development, National forests, Condemnation, Navigable waters, Wildlife management.
Identifiers: Land acquisition.

Arkansas consents to United States' purchase of and cedes its jurisdiction to any site or grounds for the erection of any navy yard, custom house, lighthouse, lock, dam, or fish hatchery. When necessary the United States may acquire Arkansas land by purchase, condemnation, or otherwise for the construction of dams, reservoirs, floodways, canals, hydroelectric power plants, channel improvement and channel diversions for the control of floods, irrigation of lands, and the development of hydroelectric power. The federal government may acquire Arkansas forest lands for national forest purposes in cooperation with the state for the protection of navigable stream watersheds. The federal government may establish fish and game regulations in national forest areas; these rules run concurrently with those of the Arkansas game and fish commission. The United States may acquire such lands and waters as the Secretary of the Interior deems necessary in furtherance of migratory bird acts. (McDonough-Florida)
W70-00406

ORGANIZATION OF DRAINAGE DISTRICTS.

Ill Ann Stat ch 42, secs 1-1 thru 1-7 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Drainage districts, *Adjudication procedure, *Jurisdiction, Legal aspects, Ditches, Drainage systems, Administration, Drains, Organizations, Legislation, Administrative agencies.

The county circuit courts have jurisdiction over all matters pertaining to the organization and operation of drainage districts. Petition for the organization of a district must be filed with, and all subsequent proceedings had in, the circuit court of the county wherein the greater portion of the land in the proposed district is located. All districts heretofore organized under prior acts, their assessments and proceedings are declared valid. The commissioners of districts organized under prior law must file a report with the appropriate circuit court for the purpose of transferring jurisdiction over and records of such existing districts to the court. For purposes of this act ditch, drain, drainage district, drainage structures, drainage system, landowner, and sanitary purposes are defined. (Marsee-Florida)
W70-00408

4B. Groundwater Management

MATHEMATICAL SIMULATION OF A STREAM-AQUIFER SYSTEM,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02A.
W70-00054

WATER WELL DRILLERS.

Ind Ann Stat secs 42-2001 thru 42-2005 (1965).

Descriptors: *Indiana, *Water wells, *Drilling, *Administrative agencies, Legislation, Drilling equipment, Land tenure, Wells, Conservation, Permits, Water levels, Regulation, Control, Legal aspects.
Identifiers: Penalties (Criminal), Licenses.

A water well drilling contractor, before drilling any water well, must secure a license from the Department of Conservation. The contractor shall keep accurate records for each water well drilled and forward a copy of the record to the Division of Water Resources of the Department of Conservation. This act shall not apply in cases where a well is drilled by the owner of land with his own drilling equipment. The license of any water well drilling contractor may be suspended by the Department for any of the reasons provided herein. Violation of the provisions of this act shall be a misdemeanor with imprisonment and/or fine as punishment. (Heckerling-Florida)
W70-00179

ANALOG-DIGITAL MODELS OF STREAM-AQUIFER SYSTEMS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W70-00204

GROUNDWATER GEOLOGY OF ALLUVIAL FAN AQUIFERS LOCATED IN THE WESTERN THIRD OF THE GWYDIR RIVER VALLEY, NEW SOUTH WALES, AUSTRALIA,
Northern Illinois Univ., DeKalb. Dept. of Geology.
Loren T. Caldwell.
Water Resources Bull, Vol 5, No 3, p 3-17, Sept 1969. 15 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Water resources, *Surveys, *Groundwater, *Aquifers, *Alluvium, Water resources development, Irrigation water, Water wells, Water yield, Hydrologic data, Data collections, Water quality, Transmissivity, Stratigraphy.
Identifiers: *New South Wales (Australia), Gwydir Valley, Alluvial fans.

Logs of 118 water wells in the western third of the Gwydir River Valley, New South Wales, Australia were studied to determine the location and extent of good aquifers in an alluvial fan. Well depths, aquifer thicknesses, water yields, and well locations are tabulated, mapped, and correlated. The aquifers consist of sand, gravel, and basaltic alluvium in distributary channels. The deepest of 4 identified aquifers is 75-250 ft deep and has a maximum capacity of 180,000 gph from 30 wells. The other 3 aquifers are shallower and have 45 wells with a total maximum yield of 138,000 gph. The surface expressions of the good aquifers may be used for locating irrigation well sites. (Knapp-USGS)
W70-00207

TECHNICAL ASPECTS OF GROUND-WATER RECHARGING (IN DUTCH),
Dienst der Publieke Werken, Amsterdam (Netherlands).
J. Bardet.
De Ingenieur, No 51, p A758-A762, Dec 20, 1968. 7 fig.

Descriptors: *Ground-water recharge, *Settlement, *Power plants, *Cooling water, Groundwater.

If ground-water is pumped up for cooling purposes, considerable risks are encountered when the subsoil layers are compressible. These risks can be minimized in many instances by judiciously planned recharging methods. As a whole, preliminary investigations, recharging-outfit maintenance and controlling measures are rather expensive. If possible, other methods of cooling, etc., would seem preferable. (Rietveld-Vanderbilt)

W70-00302

4C. Effects on Water of Man's Non-Water Activities

DRAINS AND LEVEES AFFECTING HIGHWAYS.
Ind Ann Stat secs 27-407, 27-408 (1960).

Descriptors: *Indiana, *Highways, *Erosion control, *Slope protection, Drainage, Ditches, Stream erosion, Streams, Overflow, Administrative agencies, Costs, Construction, Construction costs, Jurisdiction, Federal jurisdiction, Levees, Embankments, Roadbanks, Bridges, Eminent domain, Maintenance, Watercourses (Legal), Bank protection, Bank erosion, Legislation, Legal aspects, Navigable waters, Right-of-way, Drainage systems.
Identifiers: *Highway protection.

Governing bodies or state agencies charged with the construction, maintenance, and repair of public highways and bridges may protect same from damage by erosion, wash, slides, change of course or overflow by: (1) changing or restoring the course of any watercourse; (2) protecting the banks or slopes of watercourses by necessary construction work; or (3) constructing walls or levees if practicable or less expensive. When any navigable stream is under the jurisdiction of a federal authority or agency and the proposed work conflicts with that jurisdiction, highway officials must obtain the consent of such agency before commencing work. Maintenance and construction costs must be paid out of the appropriate fund of the agency performing the work. The governing or administrative bodies charged with the control of highways may procure rights of way, property, or interests in land outside the limits of any highway by grant, purchase, donation, or eminent domain. Persons wishing to alter drainage systems along highways must first receive approval from the State Highway Commission of Indiana or the board of county commissioners; this provision does not affect the restoration of existing ditches or drainage systems to their original specifications. (Marsee-Florida)
W70-00011

SOME EFFECTS OF URBANIZATION ON RUNOFF AS EVALUATED BY THORNTHWAITE WATER BALANCE MODELS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Geography.
Robert A. Muller.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 127-136, 1967. 10 p, 4 fig, 5 tab, 5 ref.

Descriptors: *Rainfall-runoff relationships, *Water balance, *Urbanization, New Jersey, Evaporation, Rainfall, Runoff, Hydrologic budget, Infiltration, Water storage, Flood control.
Identifiers: Thornthwaite method, Raritan River basin (NJ).

In order to gain some understanding of hydroclimatological processes and interrelationships associated with urbanization of drainage basin, water balance methodology including the Thornthwaite potential evapotranspiration and water balance models are applied to the Raritan River basin in New Jersey. The precise objectives are to compare and contrast selected Thornwaite water balance components as calculated by several more or less 'standard' techniques, to demonstrate that potential evapotranspiration and water balance models can be utilized as hydroclimatological controls to obtain first approximations of the consequences of land cover type change or urbanization within a river basin, and to explore briefly generated water balance data based on the assumption of the transformation of a watershed from rural to urban. Calculated runoff takes into account the monthly and seasonal variation of precipitation and soil moisture storage as well as energy availability for evapotranspiration loss. Measured runoff not only includes the climatic variation but in addition the effects of land use change. Hence, the differences between calculated and measured runoff over time should be a measure of the effects of land use change on runoff. (Knapp-USGS)
W70-00057

WATERS--RIPARIAN RIGHTS--PROPERTY IN FLOW OF STREAM.

Colum L Rev, Vol 45, No 5, p 792-795, Sept 1945. 4 p, 23 ref.

Descriptors: *Riparian rights, *Federal government, *Water utilization, *Streamflow, Stream improvement, Navigation, Industries, Damages, Compensation, Judicial decisions, Navigable waters, Non-navigable waters, Easements, Water level fluctuations, Legal aspects, Streams, Hydroelectric plants, United States, Ownership of beds, Water rights.

Power from claimant's hydroelectric plant located on a navigable stream was developed by the fall of water from the artificially raised level of a non-navigable stream entering into the St. Croix, a navigable stream. The level of the St. Croix was raised by the United States to improve navigation, thus causing a loss of power to claimant. The United States Supreme Court held that the economic loss suffered by claimant was not a taking of property for which compensation must be made under the Fifth Amendment. The existence of private property rights in the bed of a navigable stream is determined by the law of the state in which the stream is located. However, these rights are subject to the superior rights, powers, or dominant easements possessed by the federal government. It is well settled that there can be no private property rights in the flow of a navigable stream as against the government. It would seem that if the court had considered the economic loss in the instant case as consequential, the holding would have been more in accord with prior precedents. Moreover, in an analogous situation, the interference with subsurface drainage, the result has also been held consequential. (Heckerling-Florida)
W70-00091

JURGESON V ROMINE (DAMAGES RESULTING FROM OBSTRUCTING THE FLOW OF A CREEK).
442 SW2d 176-178 (Ct App Mo 1969).

Descriptors: *Missouri, *Obstruction to flow, *Flood damage, *Damages, Crops, Streams, Legal aspects, Judicial decisions, Floodwater, Brush, Usufructuary right, Rain, Floods, Relative rights.

Plaintiff sued defendant for damages to growing crops caused by the flooding of plaintiff's crop land. Defendant deposited logs, brush, and other debris in a creek at a place where it flowed across his land. Several months later, plaintiff's crop land, which was adjacent to and upstream from defendant's property, was inundated by flood waters. The defendant appealed the lower court's decision in favor of plaintiff on the basis of instructions to the jury relating to damages. The lower court's instructions did not distinguish the cause of the damages from defendant's act of obstructing the creek and the damages that would naturally ensue from the heavy flooding. The court held that the instructions to the jury should inform them of the necessity of determining whether the damages alleged were caused by the obstruction or the flooding. Defendant could only be liable for damages proximately resulting from his obstructing the flow of the creek. (Holt-Florida)
W70-00104

GIANT FOOD INC V WASHINGTON-ROCKVILLE INDUSTRIAL PARK INC (DAMAGES FROM DRAINAGE).
253 A2d 867-872 (Md 1969).

Descriptors: *Maryland, *Drainage, *Drainage effects, *Drainage practices, Drainage water, Groundwater, Drainage systems, Land management, Paving, Running waters, Soil conservation, Surface waters, Excess water (Soils), Surface runoff, Mudflows, Soils, Silts, Legal aspects, Judicial decisions, Runoff, Floods, Floodwater.
Identifiers: Civil procedure, Demurrers.

This action arose when the original defendants, now third-party plaintiffs, were not allowed to join certain third-party defendants in a suit which was instituted against them by plaintiff Parklawn Inc, a large commercial cemetery in Montgomery County. Parklawn brought the original action to recover damages resulting from third-party plaintiffs' failure to take precautions necessary to prevent an increased run-off of water, dirt, silt, and debris onto plaintiffs' land. Such damage was allegedly caused when the owners of a shopping center complex next to Parklawn failed to make suitable adjustments to the natural drainage system after altering the natural state of the land in building the shopping center. The Maryland Court of Appeals held that, since Parklawn alleged negligence on the part of the defendants who in turn alleged that third-party defendants were liable to them for contribution, the lack of concert ab initio in the negligence which caused Parklawn's damage did not preclude third-party plaintiffs' joining such third-party defendants. The case was reversed and remanded with direction. (Johnson-Florida)
W70-00176

SEWERS AND DRAINS IN CITIES AND TOWNS.

Ind Ann Stat secs 48-3948 thru 48-3950 (Supp 1968).

Descriptors: *Indiana, *Local governments, *Drains, *Sewers, Administrative agencies, Construction, Benefits, Costs, Cost allocation, Cost-benefit theory, cost-benefit analysis.

Whenever the Board of Public Works orders the construction of any local sewer or drain, it shall adopt a resolution to that effect. A hearing will be held, after which the Board shall decide if the benefits to be derived are worth the estimated cost. (Darragh-Florida)
W70-00190

WATER RIGHTS.
Ind Ann Stat secs 27-1401 thru 27-1409 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Water rights, *Water users, *Water allocation (Policy), Preferences (Water rights), Riparian rights, Administrative agencies, Competing uses, Regulated flow, Relative rights, Domestic water, Impounded waters, Equitable apportionment, Industrial water, Irrigation programs, Low-flow augmentation, Water requirements, Reservoir operation, Distribution patterns, Distribution, Water contracts, Stock water, Surface waters, Groundwater, Watersheds (Basins), Beneficial use, Legislation, Reasonable use.
Identifiers: Public waters.

Surface waters of the state must be put to beneficial uses to the fullest extent possible in the interests of the general welfare. Water in any natural body, stream, or lake is a natural resource and public water. Diffused surface water is not public water. Owners of land contiguous to a public watercourse may impound or use diffused surface water for domestic needs when the flow in the stream or lake level is in excess of existing reasonable uses. Entities creating additional stream volumes by releases from impoundments may use such increased flowage, but riparian owners shall have no rights therein beyond normal stream flow. Upon approval of the Indian Flood Control and Water Resources Commission, persons may divert floodwaters for any useful purposes. The Commission shall mediate disputes between users of surface waters and may require reports on the volume of surface and

groundwater used. The Commission may dispose of and sell certain stored water. Surface water, groundwater, diffused surface water, watercourse, watershed, flood water of a watercourse, and water supply are defined. Standards for measurement of flowing and stored water are established. (Marsee-Florida)
W70-00198

THE WATER RESOURCE,
Department of the Interior, Washington, D.C.
For primary bibliographic entry see Field 06G.
W70-00272

4D. Watershed Protection

AN OPERATIONS RESEARCH APPROACH TO BASIN SEDIMENT CONTROL,
Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering Science.
Erhard F. Joeres.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 261-273, 1967. 13 p, 3 fig, 18 ref, 1 appe .d.

Descriptors: *Sediment control, *Optimization, *Dynamic programming, Sedimentation, Erosion, Economics, Costs, Floods, Damages, Computer programs, Model studies, Mathematical models.
Identifiers: *Sediment control optimization.

An economic investigation was made of the problem of drainage basin sediment control, and an analytical system was developed to optimize control measures to best meet the needs of society. Dynamic programming was used in the optimization because the elements of sedimentation costs are relatively independent of each other, and downstream decisions are influenced by actual operations upstream in the drainage basin. A schematic flow chart describes the optimization process, and the mathematical basis of each step is discussed. (Knapp-USGS)
W70-00060

OUTLINE OF ARKANSAS PLAN ON WATERSHED MANAGEMENT.

Am Forests, Vol 61, No 1, p 17, Jan 1955. 1 p.

Descriptors: *Arkansas, *Watershed management, *Surface waters, *Administration, Riparian rights, Appropriation, Condemnation, Regulation, Permits, Beneficial use, Administrative agencies, Recreation demand, Cities, Industrial water, Agricultural watersheds, Conservation, Administrative decisions, Legislation.

Arkansas follows the riparian doctrine. The riparian owner's right is a vested one and probably cannot be taken except by condemnation. Arkansas' water rights bill is intended to accomplish the following results: (1) declare the public policy to be that title and control of surface waters in excess of domestic needs of riparian owners is in the state; (2) create a water permit system favoring early applicants and those making a beneficial use of such water; (3) exempt domestic use from permits; (4) be flexible enough to permit the water commission to determine whether preference in a given watershed should be given to recreation and conservation of wildlife, municipal, industrial, agricultural, or other beneficial purposes; (5) provide for adequate notice to satisfy due process, and once a right conferred, it will have incidents of ownership similar to those in states following the appropriation doctrine, and (6) provide for adequate judicial review of administrative decisions. (Holt-Florida)
W70-00087

WABASH VALLEY COMPACT.
Ind Ann Stat secs 68-906 thru 68-911 (1961).

Descriptors: *Indiana, *Interstate commissions, *Resources, *Conservation, River basin development, Valleys, Optimum development plans, Interstate compacts, Water resources development, Interstate rivers, Water utilization, Planning.

The Wabash Valley Interstate Commission is created to encourage and facilitate coordinated development of the Wabash Valley. 'Wabash Valley' means the Wabash River, its tributaries and all lands drained by said river and tributaries. The Commission shall have the power to : (A) promote the balanced development of the Wabash Valley; (B) recommend integrated plans and programs for the conservation, development, and proper utilization of the water, land, and related natural resources of the valley; and (C) secure the necessary research and development activities. (Smith-Florida)
W70-00193

WATERSHED CONSERVANCY DISTRICTS.
Ky Rev Stat Ann secs 262.700 thru 262.795 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Administrative agencies, *Watershed management, *Watersheds, Erosion control, Flood control, Sediment control, Water conservation, Multiple-purpose projects, Decision making, Programs, Project planning, Water districts, Legislation, Financing, Condemnation, Tax rate, Assessments, Operating costs, Taxes, Soil conservation, Operation and maintenance.

Subdistricts of a soil conservation district may be formed into watershed conservancy districts and shall constitute a government subdivision of the state and a public body corporate. Their purpose shall be to develop and execute programs relating to water conservation, flood and erosion control, and prevention of floodwater and sediment damage. Provisions for the creation of such a district are outlined. A board of directors is to be elected, and provisions are made for membership, terms, officers, and qualification. The powers of the board, including taxation, acquisition of land, borrowing money, and construction and maintenance of needed structures are detailed. Provisions for an annual budget are included, and procedures for assessing and collecting taxes are provided. The processes for annexing or detaching land from the watershed district are described. A detailed procedural process for executing programs developed by the board is included. (Schram-Florida)
W70-00368

JOINT CONSTRUCTION OF WATER SUPPLY.
For primary bibliographic entry see Field 03D.
W70-00371

EROSION CONTROL AND IMPROVEMENT OF NAVIGABLE WATERS.
Ind Ann Stat secs 48-5208, 48-5210 thru 48-5219 (1963), as amended, (Supp 1968).

Descriptors: *Indiana, *Lake Michigan, *Erosion control, *Navigable rivers, Docks, Harbors, Navigation, Bank protection, Bank erosion, Erosion, Beaches, Beach erosion, Banks, Lakes, Jetties, Sea walls, River training, Channel improvement, Canals, Navigable waters, Condemnation, Local governments, Basins, Jurisdiction, Legislation, Administrative agencies.

To prevent erosion of the beach, bank, shore or land abutting on Lake Michigan, the board of public works or council of any city or town is empowered to construct proper jetties, groins and seawalls, to cause the shore on the land side of such sea-walls to be filled, and to make improvements as required by law. Any city or town may widen, straighten, or deepen any stream, water-course, canal, navigable stream or lake for harbor, dock, or wharf purposes or to facilitate navigation. Such city may take the necessary land by gift, purchase, or condemnation. In the case of streams or navigable rivers, they shall not condemn a strip more than three hundred feet wide unless necessary to construct a turning basin. Such city or town shall exercise this jurisdiction five miles beyond its corporate limits, except that permission shall be necessary when any other city or town falls within such five mile jurisdiction. Two or more cities may join in such work or in any project to construct a swinging gate or other structure. Where a river and a canal unite, they shall be considered one river. (Smith-Florida)
W70-00392

ARKANSAS FORESTRY COMMISSION.
Ark Stat Ann sec 9-721 (Supp 1967).

Descriptors: *Arkansas, *Administrative agencies, *Flood protection, *Erosion control, Watersheds (Basins), Watersheds (Divides), Recreation, Erosion, Forests, Forest management, Reforestation, Flood control, Legislation, Land use, Watershed management, Legal aspects.
Identifiers: *State forests.

The State Forestry Commission may acquire land in the name of the state which it determines to be valuable for watershed protection, erosion and flood control, forestation, reforestation, and recreation. Such lands shall be parts of state forests. (McDonough-Florida)
W70-00407

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

COLLECTION AND INTERPRETATION OF STREAM WATER QUALITY DATA,
Michigan Univ., Ann Arbor. School of Public Health.
John J. Gannon, and C. T. Wezernak.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif. p325-338, 1967. FWPCA Grants WP-15-06 and Grant WP-91-Mich Univ.

Descriptors: *Water quality, *Surface waters, *Surveys, Water analysis, Water pollution effects, Water chemistry, Aqueous solutions, Suspended load, Data collections, Hydrologic data, Hydrographs, Hydrograph analysis.
Identifiers: Water quality surveys.

The methods of designing and executing stream water quality surveys are reviewed and illustrated. Physical measurements, monitoring, water quality measurements, data summary, and interpretation are discussed. A bibliography of 34 references is included. (Knapp-USGS)
W70-00063

INVENTORY OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER EASTERN TENNESSEE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-00240

SPECTROPHOTOMETRIC DETERMINATION OF CHROMIUM WITH XYLENOL ORANGE AND METHYLTHYMOL BLUE,
Missouri Univ., Kansas City. Dept. of Chemistry.
K. L. Cheng.
Talanta, Vol 14, p 875-877, 1967. 3 p, 6 ref. Work supported by Grad School, Missouri Univ, and OWRR, Dept of Interior.

Descriptors: *Analytical techniques, *Chemical analysis, *Spectrophotometry, *Chromium, Laboratory tests, Colorimetry, Chemistry, Color reactions, Indicators, Test procedures.

Identifiers: Xylenol orange, Methylthymol blue, Complex ions.

A new simple and sensitive method for determining traces of chromium is described. Xylenol Orange and chromium (III) form a red complex at pH 3 on heating in boiling water for 20 min. The molar absorptivity is 19,000. No catalytic action of the bicarbonate ion, carbon dioxide, or chromium (II) generated by metallic zinc was observed. Methylthymol Blue is a less sensitive reagent for chromium, the molar absorptivity being 11,500. (Knapp-USGS)
W70-00260

THE FUTURE OF INSTRUMENTATION IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
James H. McDermott, Dwight G. Ballinger, and William T. Sayers.
Analysis Instrumentation, Vol. 6, p 97-104, 1969. 1 tab, 3 fig, 13 ref.

Descriptors: *Instrumentation, Management, Planning, Sanitary engineering, *Surveillance, *Water pollution control.

Public recognition of the fact that our water resources are limited has led to a stepped-up program for preserving and enhancing the quality and value of this natural resource. This is reflected in recent Federal and state legislation and in the size of the national clean-up program. Concomitant to this program is the need for field, laboratory, and aerial instrumentation capable of evaluating and controlling waste sources and the waters receiving these wastes. Automatic instrumentation presently available and that in the future are discussed.
W70-00305

COMMUNITIES OF OVER 1000 POPULATION WITH WATER CONTAINING IN EXCESS OF 1000 PPM OF TOTAL DISSOLVED SOLIDS.
Black and Veatch, Kansas City, Mo.
For primary bibliographic entry see Field 05F.
W70-00308

5B. Sources of Pollution

MATHEMATICAL MODELS FOR EXPRESSING THE BIOCHEMICAL OXYGEN DEMAND IN WATER QUALITY STUDIES,
Iowa State Univ., Ames. Dept. of Civil Engineering; and Iowa State Univ., Ames. Engineering Research Inst.
Merwin D. Dougal, and E. Robert Bauman.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 242-253, 1967. 12 p, 4 tab, 13 ref. OWRR Proj No A-001-IA.

Descriptors: *Biochemical oxygen demand, *Mathematical models, *Statistical models, Statistical methods, Oxidation, Oxygen demand, Dissolved oxygen, Water pollution effects, Computer programs, Forecasting.
Identifiers: BOD Models, Monomolecular BOD models.

The development and application of the widely-used monomolecular model for biochemical oxygen demand BOD is reviewed. Results of laboratory BOD studies are used to reveal that the monomolecular model fails to satisfy its fundamental assumptions. Temporal variations in the rate constant and the ultimate BOD value are explored for three types of wastes: (a) raw domestic sewage, (b) final effluents from various waste treatment processes, and (c) contents of an agricultural waste lagoon. Two different mathematical models for BOD are presented which statistically are superior to the monomolecular model. These models may be useful in future studies of stream water quality and in the determination of stream assimilative capacities. (Knapp-USGS)
W70-00059

THE IMPACT OF ANIMAL WASTES ON WATER RESOURCES ACTIVITIES,
Kansas Univ.,Lawrence. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W70-00062

PANTHER COAL CO V LOONEY (MINE WATER POLLUTION).
For primary bibliographic entry see Field 05G.
W70-00167

INVENTORY OF RADIONUCLIDES IN BOTTOM SEDIMENT OF THE CLINCH RIVER EASTERN TENNESSEE,
Geological Survey, Washington, D.C.
P. H. Carrigan, Jr.
Geol Surv Prof Pap 433-I, 1969. 18 p, 14 fig, 5 tab, 20 ref.

Descriptors: *Path of pollutants, *Radioactive wastes, *Tennessee, Radioisotopes, Sediments, Alluvium, Radiochemical analysis, Water pollution sources, Water pollution effects, Sampling, Surveys.
Identifiers: Oak Ridge, Clinch River (Tenn).

An inventory has been made of the radionuclides associated with bottom sediment in the lower Clinch River. The reach included in this inventory extends 21 miles from the mouth of the river to the mouth of Whiteoak Creek. The source of the radionuclides in the sediments was the release of low-level-radioactive waste waters from the Oak Ridge National Laboratory into Whiteoak Creek basin and thence into the river via Whiteoak Lake. Results of the inventory indicate that the following quantities of radioactivity were associated with the bottom sediment in July 1962: 150 curies of cesium-137; 18 curies of cobalt-60; 16 curies of ruthenium-106; at least 10 curies of rare earths; and 2.9 curies of strontium-90. Most of the radioactivity was found to be downstream from mile 15; about 95% of the identified radioactivity was in this reach. Maximum concentration of radioactivity occurred near the mouth of Whiteoak Creek. A high proportion of cesium-137 (21%), rare earths (about 25%), and cobalt-60 (9%) released to the river are retained in bottom sediment of the study reach. Retention of ruthenium-106 and strontium-90 is minor--less than 1% each. (knapp-USGS)
W70-00240

LAKE MICHIGAN POLLUTION AND CHICAGO'S SUPPLY,
Department of Water and Sewers, Chicago, Ill.
Hyman H. Gerstein.
J American Water Works Association, Vol 57, p 841-857, July 1965. 7 fig, 7 tab.

Descriptors: *Lake Michigan, *Water supply, Intakes, Nutrients, Quality control, Treatment facilities, Filtration, Sewage, Coliforms, Eutrophication, Odor, Ammonium compounds, Activated carbon, Chlorine, Phenols, Oil wastes, Hydrogen ion concentration, Fluorides, Alkyl benzene sulfonates, Wind velocity, Taste, Coagulation, Plankton, Monitoring, Temperature, Detergents, Phosphorus compounds, Diatoms, Biochemical oxygen demand, Dissolved oxygen, Color, Dissolved solids, Biodegradation, Algae, Iron, Sulfates.
Identifiers: *Pollution, *Chicago (Ill), Cook County (Ill), Calumet River (Ill), Pools, Wind direction, Tabellaria, Fragilaria, Asterionella, Filter clogging, Stephanodiscus hantzschii, Stephanodiscus binderanus, Cladocera, Water masses, U S Public Health Service, Great Lakes-Illinois River Basins Project, Indiana Harbor Ship Canal.

Although no sewage and industrial wastes are discharged along 30 miles of Chicago's lake front, gross pollution exists in the southern end of Lake Michigan. Data over 40 years reveal quality at the intakes, and, from 1950 to 1964, illustrate pollutional trends. A general increase of eutrophication indicators and increase in number and intensity of periods when pollutants seriously affected the intake at the South plant appear in the last ten years. Slugs of wastes may have abnormal odors, like those of oil refinery wastes diluted with lake water. Since 1948, samples have been collected one day each week at established points. Pollutional pools, influenced by wind-induced lake currents, were observable in a series of taste and odor incidents. The principal agent in treatment for removal of taste and odor is activated carbon. In treating highly polluted waters, application of chlorine sufficient to decompose ammonia-nitrogen may not adequately destroy the bacteria, whereupon bacteriologically unsafe water may result. Increasing plankton growth necessitates more frequent washing of filters; increased growth of filamentous algae together with appearance of new species of diatoms have caused additional problems with filters. Author presents, as practical and desirable, a series of criteria for quality of Chicago's water supply. (Jones-Wisconsin)
W70-00263

PHYSICAL, CHEMICAL, BACTERIAL, AND PLANKTON DYNAMICS OF LAKE PONTCHARTRAIN, LOUISIANA,
Louisiana State Univ., Baton Rouge.
Daniel H. Stern, and Michele S. Stern.
Louisiana Water Resources Research Inst Tech TR-4, Sep 1969. 60 p, 2 fig, 47 tab, 33 ref. OWRR Proj A-019-LA.

Descriptors: *Limnology, Sline lakes, Storm runoff, *Chemical properties, Physical properties, *Ammonia, Nitrification, Nitrates, Nitrites, Dissolved oxygen, Turbidity, Phosphates, Nutrients, *Coliforms, *Phytoplankton, Water sports.
Identifiers: *Lake Pontchartrain (La).

Sampling from Lake Pontchartrain between November 1968 and July 1969 shows that storm water from canals in Orleans and Jefferson Parishes degrades the water quality and disturbs the biorhythm of the aquatic microbiota. Especially after heavy rains, the increase in coliforms renders nearshore water and certain beaches unsafe for primary water sports. Phytoplankton, whose growth increases owing to nutrients in the storm runoff, add to the bottom organic materials when they die because the light available for photosynthesis has been reduced by turbidity. Bottom organic sediments stirred up by wave action during storms not only cause the turbidity but also furnish food for new planktonic growth. Thus the filling of the lake is hastened. The relationship between the total and fecal coliforms was not consistent. Recommendations include: counting of fecal coliforms to obtain a truer indication of pollution; prohibition of primary water sports at certain beaches after summer rains; careful regulation of proposed storm-water chlorination owing to the presence of ammonia, which retards disinfection and because of possible unreacted chlorine, which will disrupt the natural food cycle; and basin-wide cooperation to halt further pollution. (Hill-Louisiana State Univ)
W70-00309

PRELIMINARY MASS BALANCE OF BOD ON THREE NEW JERSEY RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Water Resources Research Institute, Rutgers University. OWRR Proj B-002-NJ. Oct 1969. 94 p.

Descriptors: *Biochemical oxygen demand, *BOD, *Organic matter, *Water quality, *Organic loading, Oxygen demand, Dissolved oxygen, Oxygen, Oxygen sag, Water pollution, Effluents.
Identifiers: *BOD mass balance, Unknown organic loading, Unrecorded organic loading, Recorded organic loading, Background organic loading.

A preliminary accounting for organic loading of three New Jersey river basins was undertaken, with the intention of finding a measure of gross man-made pollution. The method used is called a BOD

mass balance analysis, being essentially a reconciliation between organic loadings in the streams, as revealed by water quality records, and the proportion of the loadings accountable for by recorded effluents from waste treatment plants. The most important finding is that on none of the three rivers did the recorded effluents account for as much as half of the total pollution in the stream. After subtraction of estimates of probable background loading, the remaining unknown but presumably man made wastes were very large. The implications from the viewpoint of water quality control are serious. (Whipple-Rutgers)
W70-00314

NORTH SUBURBAN SANITARY SEWER DISTRICT V WATER POLLUTION CONTROL COMM'N (WATER POLLUTION CONTROL STANDARDS).
For primary bibliographic entry see Field 05G.
W70-00397

5C. Effects of Pollution

RELATION OF WATER QUALITY TO STRIPED-BASS MORTALITIES IN THE CARQUINEZ STRAIT OF CALIFORNIA,
Geological Survey, Menlo Park, Calif.
William D. Silvey, and George A. Irwin.
Geol Surv Open-file Rep, Mar 20, 1969. 12 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Fishkill, *Striped bass, *Water pollution effects, *California solutes, Dissolved oxygen, Hydrogen sulfide, Toxicity, Morbidity, Industrial wastes, Solutes, Copper.
Identifiers: *Carquinez Strait (Calif).

No direct quantitative relations were found to indicate the cause of striped-bass mortalities in the Carquinez Strait area, California. Several possible causes of the mortalities were considered but could not be proven. Industrial effluents were considered as a possible cause of mortalities, but evidence was not found to show this possibility. Heavy metals (zinc, lead, and chromium) were analyzed but not found in large concentrations. Copper was found throughout the entire estuary in concentrations of about 0.10 mg/l. If copper was the responsible agent, the mortalities would have been widespread throughout the estuary, but they were not. Mortalities did not occur as a result of spawning. The lack of osmoregulatory adaptation to the sharp salinity gradient in Carquinez Strait is not a major cause of the mortalities. One major probable cause of the mortalities was natural hydrogen sulfide production. Large concentrations of biologically produced hydrogen sulfide were found on and in mudflats in Carquinez Strait at the time of the mortalities peak. Although this alone does not prove a direct cause and effect relation, biologically produced hydrogen sulfide, a natural phenomenon, is the most likely cause of striped-bass mortalities in Carquinez Strait. (Knapp-USGS)
W70-00005

THE IMPACT OF ANIMAL WASTES ON WATER RESOURCES ACTIVITIES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Raymond C. Loehr.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 314-324, 1967. 11p, 2 fig, 2 tab, 28 ref.

Descriptors: *Farm wastes, *Confinement pens, *Water pollution sources, Waste disposal, Runoff, Water quality, Oxygen demand, Nutrients, Waste disposal.
Identifiers: Animal production industry wastes.

Until recently animal wastes have been considered as part of the natural or background pollution of a region, and uncontrollable. Animal production is changing from small farm operations into large scale industrial enterprises. There is an increasing trend to confine animals within small areas to produce the greatest weight gain in the shortest period of time. Under such conditions, it is not possible for these animals to drop their wastes on pastures where the wastes can be adsorbed by nature without adversely affecting environment. Animal wastes have been shown to be a major source of surface water pollution and have been implicated in several cases of ground water pollution. Some cases of pollution that have been caused by animal wastes and animal production operations are discussed and the trend toward confinement feeding operations and the magnitude of the problem are outlined. The need to consider animal wastes when developing or protecting water resources is demonstrated. On a volume basis, the total animal waste production in the United States exceeds that by the human population by an order of magnitude. (Knapp-USGS)
W70-00062

COMPUTATION OF LONGITUDINAL MIXING OF POLLUTION MATTER IN FLOWS (IN RUSSIAN),
Tallinn Polytechnic Inst. (USSR).
A. M. Aitsam, H. A. Velner, and L. L. Paal.
Sbornik statei po sanitarnoi technike IV, Trudy talinskogo politekhnitcheskogo instituta, seriya A, No 247, p 57-65, 1967.

Descriptors: *Mathematical models, *Turbulence, *Diffusion, *Mass transfer, Water pollution, Self-purification, Water quality, Stream pollution.
Identifiers: Turbulent mixing coefficient.

The basic equation of turbulent mass transfer of nonconservative pollutants was solved by Laplace transformation. The analytical solution obtained was complex, but was simplified and the approach to computation of it evaluated and shown practically. The values of the longitudinal mixing coefficient ascertained in some Estonian streams ranged from 0.1 to 1.0 msq/sec., and the decay coefficient of BOD decomposition rate lay within the interval from 0.1 to 1.0 1/day. The formula which was valid in the first step only for constant flow rate (Q= const.) including the linear dependence of discharge on distance, was used on the case of gradually increased flow rate. (Novotny-Vanderbilt)
W70-00146

COMPUTATION OF WASTE WATER MIXING AT SOME FIGURES OF WASTE LOAD OF FLOWS (IN RUSSIAN),
Tallinn Polytechnic Inst. (USSR).
L. L. Paal.
Sbornik statei po sanitarnoi technike IV, Trudy talinskogo politechnitcheskogo instituta, seriya A, No 247, p 75-89, 1967.

Descriptors: *Mathematical models, *Turbulence, *Mass transfer, Water pollution, Water quality, Stream pollution.

Solution of concentration wave at triangular, trapezoidal, exponential, and periodical waste load figure is based on the one-dimensional equation of longitudinal turbulent mixing of nonconservative matter. This equation containing the time derivative was solved by the Laplace transformation method respecting boundary conditions. (Novotny-Vanderbilt)
W70-00147

THE ENGINEERING CALCULATION OF THE PERMITTED LOADS OF THE POLLUTED WATER FLOWS (IN RUSSIAN),
Tllinn Polytechnic Inst. (USSR).
A. M. Aitsam, H. A. Velner, and L. L. Paal.
Materialy po voprosam samoochishcheniya vodoyomov i smeshcheniya stochnikh vod, Tall Pol Inst, p 87-108, June 7-10, 1965. 9 ref.

Descriptors: *Self-purification, *Oxygen sag, Waste assimilative capacity, Water pollution effects, Water quality, Stream pollution, Mathematical models, Environmental engineering.

Analytical solution of mass balance of either nonconservative or conservative pollutants in streams is presented. This solution is applied on BOD, DO, and conservative pollutants concentration changes, and was recommended for the water quality computation of small streams in Estonian SSR. The values of k (1), according to the kind of waste waters discharged into these streams, are tabulated and in the same way the values of Fair's factor f are computed. The solution takes into account the gradually increased flow rate and an additional BOD load. Practical examples and comparison with measured data of a small river basin are given. (Novotny-Vanderbilt)
W70-00148

COMPUTATION OF OXYGEN BALANCE OF WATERS POLLUTED BY WASTE WATERS (IN RUSSIAN),
Tallinn Polytechnic Inst. (USSR).
A. M. Aitsam, H. A. Velner, and L. L. Paal.
Sbornik statei po sanitarnoi technike I, Trudy talinskogo politekhnitcheskogo instituta, seriya A, No 212, p 103-129, 1964. 25 p, 9 fig.

Descriptors: *Waste assimilative capacity, *Oxygen sag, *Self purification, Water quality, Stream pollution.

The Streeter-Phelps formula for dissolved oxygen computation in small streams is criticized and a new differential equation of oxygen balance taking into account the dilution rate of waste in stream is proposed. On this basis it was stated that the Streeter-Phelps formula was valid only if waste waters discharged into rapidly flowing waters. The most critical point from the standpoint of the dissolved oxygen content is the reach of steam just below the waste effluent discharge. The field observation of some small streams in Estonian S.S.R. were used as a proof of validity of the proposed mathematical model. (Novotny-Vanderbilt)
W70-00149

THE MIXING OF WARM WATER FROM THE USKMOUTH POWER STATIONS IN THE ESTUARY OF THE RIVER USK,
Central Electricity Generating Board, Portishead (England). Research and Development Dept.
C. M. De Turville, and R. T. Jarman.
Int Journal Air and Water Pollution, Vol 9, p 239-251, 1965. 9 fig, 1 tab, 9 ref.

Descriptors: *Diffusion, Thermal power plant, Estuary, Thermal pollution, Cooling water, Mixing, Waste dilution.
Identifiers: Thermal water flumes, Diffusion coefficient, River temperature, Bridge-amplifier circuit, Ebb tide, Turbulent diffusion, Lateral diffusion, River Usk.

The temperature and flow of water in the River Usk estuary adjacent to the two power stations were measured during the hours around low water in a series of boat surveys. Analysis of the measurements made on the ebb tide showed that (a) the current was constant from 120 min before low water until the flow reversal occurred, (b) the flow reversal took 20 min on a spring tide (47 ft, 14 m) and was longer on a neap tide, (c) the warm water was bounded on each side with cool water and mixed laterally with it, and (d) the lateral diffusion coefficient was approximately 20000 cm sq./sec, which is similar to that found in oceans, if the scale length is taken to be the effective width of the estuary. (Ross-Vanderbilt)
W70-00150

EFFECTS OF HEATED DISCHARGES ON THE TEMPERATURE OF THE THAMES ESTUARY - II,
Water Pollution Research Lab., Stevanage (England).
A. L. H. Gameson, H. Hall, and W. S. Preddy.
Combustion, Vol 32, No 7, p 37-45, Jan 1961. 7 fig, 9 ref.

Descriptors: *Estuaries, *Heat transfer, Thermal pollution, Discharge (Water), Tidal effects, Mixing.
Identifiers: *Heated discharges, Thames Estuary, Tidal mixing, Temperature distribution.

This paper discusses rate of exchange of heat, derives equations for heat transfer and considers application of the methods used. Heat entering the estuary is dispersed by tidal mixing and displaced toward the sea by the flow of land water. The movement of the water and the mechanism by which the excess heat is lost is explained. Diagrams are given showing the distribution of water after periods of one, two, and three tides using various representations of symmetric mixing. The effects of radiation, evaporation, conduction, and convection on heat exchange are discussed. The four processes which occur in the estuary during the dispersion and cooling of a heated effluent are also discussed. (Ross-Vanderbilt)
W70-00158

CORRELATION BETWEEN PHOTOSYNTHESIS AND LIGHT-INDEPENDENT METABOLISM IN THE GROWTH OF CHLORELLA,
Tokugawa Inst. for Biological Research, Tokyo (Japan).
H. Tamiya, T. Iwamura, K. Shibata, E. Hase, and T. Nihei.
Biochimica et Biophysica ACTA, Vol 12, p 23-40, 1953. 13 fig, 3 tab, 6 ref.

Descriptors: *Chlorella, *Correlation analysis, *Photosynthesis, *Metabolism, Light intensity, Chlorophyll, Spores, Aerobic conditions, Temperature, Volume, Phosphorus, Nitrogen, Nutrients, Carbon dioxide, Respiration, Inorganic compounds, Oxygen, Anaerobic conditions, Growth rates, Life cycles, Growth stages.
Identifiers: *Growth, *Chlorella ellipsoidea, 'Dark cells', 'Light cells', Transformation, Interconversion, Nascent dark cells, Active dark cells, Autospores.

In culture, Chlorella cells assume two distinct forms, 'dark cells', smaller in size, richer in chlorophyll content and stronger in photosynthetic activity than the other, the 'light cells'. When illuminated, dark cells grow, with a substantial increase in mass, and turn into light cells; the latter, when ripened, bear autospores which are eventually set free, becoming individual dark cells. Transformation of light cells into dark cells involves no increase of cell mass and occurs only under aerobic conditions, either in light or dark. Dark cells freshly born from light cells are smaller in size and contain less chlorophyll than 'active' dark cells, into which the former turn rapidly under influence of light. In transformation of dark cells into light cells the main thrust is photosynthesis. Transformation of light cells into dark cells involves a light-independent and aerobically endergonic anabolic metabolism, although the transformation, in light, is accompanied by some photosynthetic processes. Authors found that, under weak light, the rate of growth is exclusively determined by photosynthetic processes, whereas light-independent metabolic processes become more or less significant in determining over-all growth rate in strong light. Formulae are constructed describing the processes. (Jones-Wisconsin)
W70-00261

LAKE MICHIGAN POLLUTION AND CHICAGO'S SUPPLY,
Department of Water and Sewers, Chicago, Ill.
For primary bibliographic entry see Field 05B.
W70-00263

DEATH OF A LAKE,
David C. Flaherty.
Quest, Vol 6, No 4, p 7-15, 1968. 9 fig.

Descriptors: *Lakes, *Algae, *Eutrophication, Oligotrophy, Nutrients, Water temperature, Dissolved oxygen, Fishkills, Limnology, Algal toxins, Algal control, Trace elements, Washington, Nuclear powerplants, Water pollution effects, Phosphorus, Nitrogen.
Identifiers: *Cultural eutrophy, *Nutrient balance, *Lake aging, Nutrient sources, Water sampling, Algal growth, Oxygen depletion, Nuclear activation techniques, Rock Lake (Wash), Williams Lake (Wash), Channeled Scablands (Wash), Washington State University.

Algae are the primary producers which initiate the food chain in lakes leading up to fish and man. In normal lakes, a rough balance exists between incoming nutrients, algal numbers, and their predators. However, this balance is upset by man's influence, hastening change from oligotrophic to eutrophic conditions. Detrimental effects of large numbers of undesirable algal forms, include oxygen depletion resulting in fishkills; flavor, odor, and color in water supplies; induced corrosion and slime in industrial water supplies; and endangering of other aquatic and terrestrial life forms from toxic substances. Studies conducted by Dr. William Funk, Washington State University Civil Engineering professor, on Rock and Williams Lakes in the Scablands basalts of eastern Washington are described. The basalts are relatively low in nitrogen and phosphorus, and decompose slowly, with consequent low natural nutrient income. However, these lakes are endangered by human activities. Present studies measure dissolved oxygen, temperature, light penetration, algal species, and concentrations of various elements including phosphorus and nitrogen. Nuclear activation techniques are used to detect trace elements which Dr. Funk suspects may have a critical role in algal growth. (Ketelle-Wisconsin)
W70-00264

PRIMARY PRODUCTION IN LABORATORY STREAMS,
Oregon State Univ., Corvallis. Dept. of Fish and Game Management; Oregon State Univ., Corvallis. Dept. of Botany; and Oregon State Univ., Corvallis. Pacific Cooperative Water Pollution and Fisheries Research Labs.
C. David McIntire, Robert L. Garrison, Harry K. Phinney, and Charles E. Warren.
Limnology and Oceanography, Vol 9, No 1, p 92-102, Jan 1964. 5 fig, 3 tab, 20 ref.

Descriptors: *Primary productivity, *Streams, *Laboratory tests, Respiration, Environment, Photosynthesis, Oxygen, Trophic level, Light intensity, Ecology, Lotic environment, Biomass, Flow rates, Depth, Dissolved oxygen, Algae, Velocity, Water quality, Dissolved solids, Hydrogen ion concentration, Temperature, Nitrogen, Nutrients, Organic matter, Pigments, Chlorophyll, Diffusion, Cyanophyta.
Identifiers: Community, Specific conductance, Species, Melosira varians, Synedra ulna, Oedogonium, Phormidium retzii, Surface diffusion rate.

Six laboratory streams were used to study primary production and community respiration in simple communities under different environmental conditions. A photosynthesis-respiration chamber was developed which can be used to relate primary production to various environmental conditions and to verify direct measurement of primary production in laboratory or natural streams. Gross primary production in laboratory streams under 6000 lux of illumination ranged from 2.4 to 4.7 grams oxygen/square meter/day. Community respiration ranged from 1.6 to 4.2 grams oxygen/square meter/day. Ratios of photosynthesis to respiration usually varied between 1.0 and 2.0. Illumination intensity was approximately linearly related to primary production in range, 0-4000 lux, maximum photosynthetic rates obtaining at about 21,000 lux. Communities developing on the substrate were seeded naturally by species entering streams through the water supply. Composition of plant communities remained surprisingly constant, usually varying only in relative abundance of different species. The diatoms, Melosira varians and Synedra ulna consistently dominated; Oedogonium spp were sometimes very abundant during summer. Genera of blue-green algae were ubiquitous, frequently growing attached to sides of troughs, near the air-water interface. (Jones-Wisconsin)
W70-00265

SOME ASPECTS OF THE EUTROPHICATION OF WATER,
Water Pollution Research Lab., Stevenage (England).
Morlais Owens, and Gavin Wood.
Water Research, Vol 2, p 151-159, 1968. 3 fig, 2 tab, 17 ref.

Descriptors: *Eutrophication, *Nutrients, Cyanophyta, Fishkill, Reservoirs, Surface drainage, Fertilizers, Detergents, Sewage effluents, Industrial wastes, Lake Erie, Water pollution sources, Water pollution effects, Phosphorus compounds, Nitrogen compounds, Subsurface drainage.
Identifiers: *Great Britain, Nutrient removal, Nutrient concentrations, Nutrient sources, Algal blooms, Oxygen depletion, Flowing water, Eutrophication evaluation, Algal nutrient requirements, Surface-active materials, Lake Washington (Wash), Zurichsee (Switz), Potomac River (D C), Great Ouse (England), Lee River (England), Thames River (England), Oscillatoria rubescens, Anabaena flos-aquae, Water Pollution Research Laboratory (England).

Authors describe symptoms of eutrophication and evaluate the extent of enrichment and associated technical and economic problems. Increasing applications of fertilizers to land and greater use of detergents are partially responsible for higher concentrations of nitrogen and phosphorus in rivers of Great Britain. In the last ten years, amounts of nitrogenous fertilizers applied to agricultural land in Britain have doubled with consequent greater contributions of inorganic nitrogen to rivers from land drainage. Authors suggest, from indirect evidence, that approximately 50% of phosphorus in sewage effluents is derived from detergents. A nutrient balance sheet for a portion of the Great Ouse was constructed to determine the contribution of sewage effluents to the supply of major nutrients in the river. It indicated that while sewage effluents add only a small proportion of the total nitrogen, silicon, chloride, and sulphate, they are responsible for most of the phosphorus. Because of increased demands on water supplies, information on proportions of nutrients derived from various sources is important to base decisions on economically sound remedial action, e. g. establishment of treatment works for nutrient removal. (Ketelle-Wisconsin)
W70-00266

CHARACTERISTICS OF HYPERTROPHIC LAKES AND CANALS IN CITIES,
State Zoological Inst. and Museum, Hamburg (West Germany). Hydrobiological Station.
Hubert Caspers.
International Association of Theoretical and Applied Limnology, Proceedings, Vol 15, p 631-638, Feb 1964. 2 fig, 2 tab, 13 ref.

Descriptors: *Lakes, *Eutrophication, *Canals, *Cities, Biological communities, Sewage, Detritus, Tubificids, Plankton, Diatoms, Cyanophyta, Phytoplankton, Rotifers, Chlorophyta, Copepods, Cycles, Chlamydomonas, Algae, Zooplankton, Fish, Chrysophyta, Seston, Self-purification.
Identifiers: *Hypertrophic waters, Hamburg (Germany), Chironomids, Cladocera, Aphanizomenon flos-aquae, Stephanodiscus hantzschii, Didinium, Paramecium, Phacus, Glenodinium, Cryptomonas,

Ciliata, Asterionella formosa, Recolonization, Alster Lake (Germany), Germany.

Alster Lake in Hamburg, Germany, is an example of a typical urban lake and demonstrates the special conditions in city waters, which are specialized habitats and where hydrobiological status can be more readily analyzed than complex sites of 'healthier' waters. Urban waters may constitute a restricted facies of eutropic water where destruction of original communities is typical and no new equilibrium develops. Rather, the relationship between buildup and breakdown of nutritive material, between producers and consumers, is always in a state of temporary equilibrium, and is constantly in danger of becoming unbalanced. The original community loses its most important zone of regeneration, the submerged plants along banks; bottom fauna is burdened with anaerobic processes resulting from inflow of detritus, leaving only a few species whose mass development is inhibited. The surviving plankton tends to instability and extreme variations from year to year. Nevertheless, there are certain definite and regular events which make urbanized waters a unique experimental situation, since the restricted facies of eutrophic water affords us limnological insight into forced production processes and their ecological effects. Author believes that conditions in urban waters improve when plants recolonize the banks. (Jones-Wisconsin)
W70-00268

CHANGES IN LAKE WASHINGTON FOLLOWING AN INCREASE IN THE NUTRIENT INCOME,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson.
International Association of Theoretical and Applied Limnology, Proceedings, Vol 14, p 167-175, July 1961. 5 fig, 1 tab, 12 ref.

Descriptors: *Nutrients, *Productivity, Nuisance algae, Sewage effluents, Phosphorus, Eutrophication, Washington, Lakes, Water pollution effects.
Identifiers: *Lake Washington (Wash), *Lake changes, *Nutrient concentration, *Nutrient budget, Potential nutrient concentration, Areal income (Nutrients), Lake volume, Mean depth, Dilution, Oscillatoria rubescens, Madison lakes (Wis), Cedar River (Wash), Zurichsee (Switz), Turlersee (Switz), Greifensee (Switz), Paffikersee (Switz), Aegerisee (Switz), Fureso (Switz).

A dense bloom of Oscillatoria rubescens in 1955 prompted a study of Lake Washington to determine effects of a growing human population on lake eutrophication. One phase was an engineering survey made to establish the magnitude of sewage effluent and other sources of nutrients. Increases in nutrients from 1950-1955 were small compared with limnological changes. In order to compare the nutrient status of various lakes, a simple numerical basis of comparison of nutrient rate supply from outside sources is desirable. Systems which incorporate a consideration of the potential concentration of nutrients in lakes are preferable to those relating only income to area. Potential concentration can be related to the areal income and the mean depth of the lake as follows: areal income/mean depth=potential concentration (grams/square meter/meter=grams/cubic meter). The present work deals with only a portion of the problem--comparison of income of phosphorus among lakes. The author presents computations for several lakes in Wisconsin and Europe in addition to Lake Washington, also shows graphs of areal income plotted against potential concentration. Results of such calculations indicate that potential concentration is more closely related to algal standing crop than is the areal income. (Ketelle-Wisconsin)
W70-00270

THE DIATOMS OF A CORE FROM ESTHWAITE WATER,
Bristol Univ. (England). Dept. of Botany.
F. E. Round.
New Phytologist, Vol 60, p 43-59, 1961. 12 fig, 2 tab, 14 ref.

Descriptors: *Cores, *Diatoms, Sediments, Eutrophication, Plankton, Muds, Lake mud, Bioindicators.
Identifiers: *Esthwaite Water (England), English Lake District, Asterionella, Melosira,Cyclotella, Tabellaria.

The diatom flora of a core taken from the center of Esthwaite Water has been analyzed qualitatively and quantitatively. Five periods of deposition have been characterized by indicator species and variations in diatom productivity. The most recent brown lake muds (0-150 centimeters) contain Asterionella, Melosira, Cyclotella, and Tabellaria. Comparison with the present-day diatom flora suggests that a transition to eutrophic conditions, detected in late Post-glacial time, is still occurring. The main diatom zones show good association with the zoning derived from pollen analysis. (Bortleson-Wisconsin)
W70-00271

ISOLATION AND CULTURE OF TOXIC STRAINS OF ANABAENA FLOS-AQUAE (LYNGB.) DE BREB.,
National Research Council of Canada, Ottawa (Ontario).
P. R. Gorham, J. McLachlan, U. T. Hammer, and W. K. Kim.
International Association of Theoretical and Applied Limnology, Proceedings, Vol 15, p 796-804, February 1964. 1 fig, 3 tab, 22 ref.

Descriptors: *Algae, *Toxicity, *Cultures, *Isolation, Limnology, Public health, Physicochemical properties, Genetics, Bacteria, Peptides, Environmental effects, Heterogeneity, Iron, Manganese, Waterfowl, Cyanophyta.
Identifiers: *Anabaena flos-aquae, *Strains, Phycologists, Veterinarians, Microcystis aeruginosa, Endotoxin, Fast-death factor, Dosage, Species susceptibility, Anabaena Lemmermannii, Ottawa (Ontario), Burton Lake (Saskatchewan), Humboldt (Saskatchewan), Mice, Morphological characters, Tris.

Toxic waterblooms of planktonic blue-green algae have puzzled phycologists, limnologists, veterinarians, and public health officials for more than 80 years. The authors of this paper succeeded in isolating toxic and non-toxic strains of Anabaena flos-aquae from a toxic bloom in Burton Lake, Saskatchewan. Of fourteen strains isolated in 1960 and 1961, eight were toxic and six non-toxic. They showed, for the first time (although long suspected), that this alga can be poisonous. The fast-death factor produced is often secreted into the surrounding water. This and other properties of Anabaena very fast-death factor indicate that it is different from Microcystis fast-death factor. One sample collected in 1960 contained a very fast-death factor, killing mice in one to two minutes after intraperitoneal injection with a minimal lethal dose. Death was preceded by symptoms of paralysis, tremors, and mild convulsions. The salt concentrations giving best growth of one strain of Anabaena flos-aquae in unialgal culture bear little resemblance to those of the lake water from which it was isolated. Interesting changes in growth habit (gradual loss of colonial habit and filament coiling) were observed in culturing Anabaena flos-aquae, illustrating how variable some morphological characters can be. (Jones-Wisconsin)
W70-00273

CONTRIBUTION TO THE ECOLOGY OF WATER-BLOOM-FORMING BLUE-GREEN ALGAE -APHANIZOMENON FLOS AQUAE AND MICROCYSTIS AERUGINOSA,
Ceskoslovenska Akademie Ved, Prague. Hydrobiological Station.
J. Hrbacek.
International Association of Theoretical and Applied Limnology, Proceedings, Vol 15, p 837-846, Feb 1964. 8 fig, 2 tab, 6 ref.

Descriptors: *Algae, *Cyanophyta, *Ecology, *Eutrophication, Ponds, Reservoirs, Backwater, Fertilization, Nitrogen compounds, Phosphorus compound, Perches, Fish, Diatoms, Carp, Plankton, Metabolism, Biological communities, Daphnia, Nannoplankton, Nutrients, Depth, Domestic animals, Sampling, Nuisance algae.
Identifiers: *Aphanizomenon flos aquae, *Microcystis aeruginosa, Bohemia, Elbe River, Celakovice (Czechoslovakia), Blatna (Czechoslovakia), Cyprinid fishes, Clorococcales, Daphnia pulicaris, Daphnia cucullata, Daphnia hyalina, Daphnia magna, Czechoslovakia.

Knowledge of individual factors which either promote or inhibit water-bloom-forming cyanophytes (blue-green algae), Aphanizomenon flos aquae, and Microcystis aeruginosa is not extensive. This report is based on a comparative study of water-bodies in Bohemia. Ten backwaters in the inundation area of the Elbe River, six fish ponds, and three water reservoirs were sampled at monthly intervals from April to September. In order to examine the relative importance of nitrogen and phosphorus compounds from each of the three categories of water-bodies, the following were selected: one with water bloom consisting of Aphanizomenon with occasionally some Microcystis; one without water bloom, and, insofar as possible, one with Microcystis water bloom. In ponds, backwaters, and reservoirs with and without water blooms, no important differences in content of phosphorus and nitrogen compounds were found. In one bloom-containing reservoir, water showed significantly smaller concentrations of phosphorus compounds than in ponds. An association exists between cyanophytes and Daphnia. Depth had increasing effect on development of water bloom of these two cyanophytes. In ponds, increased fish stock accompanied decreased Aphanizomenon blooms, while in some waterbodies, larger fishstock was associated with development of Microcystis aeruginosa bloom. (Jones-Wisconsin)
W70-00274

PHYTOTOXICITY OF IMIDAZOLINE DERIVATIVES AND RELATED COMPOUNDS,
Wisconsin Univ., Madison. Dept. of Botany.
Seward E. Allen, and Folke Skoog.
Plant Physiology, Vol 26, p 611-624, 1951. 4 fig, 1 tab, 11 ref.

Descriptors: *Phytotoxicity, Agricultural chemicals, Herbicides, Weed control.
Identifiers: *Imidazoline derivatives, 1-isopropyl-4, 4-dimethyl-2-imidazolines.

Certain 1-isopropyl-4,4-dimethyl-2-imidazolines and other structurally related compounds were found to be toxic to seedlings and larger plants. Their toxic action apparently depends upon a ring nucleus containing carbon and nitrogen linked by double bonds, the lack of any polar substituents in the 4-position, and the length of an alkyl group in the 2-position; and may be due in part to their lipophilic properties. In the greenhouse, corn, wheat, and lambsquarter were fairly resistant; soybeans, table beets, peas, and red-root pigweed were moderately sensitive; and wild mustard, and tomatoes were readily killed by applications of a 0.50% spray. Because they are inactivated by contact with soil, these toxic imidazoline derivatives might be useful as pre-emergence herbicides. (Nichols-Wisconsin)
W70-00275

THE BIOGEOCHEMISTRY OF NITROGEN,
California Univ., Davis. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02K.
W70-00278

THE NITROGEN CYCLE IN THE SEA,
Washington Univ., Seattle. Dept. of Oceanography
For primary bibliographic entry see Field 02K.
W70-00279

INFLUENCE OF ELECTRIC POWER PLANT ON LIMNOLOGICAL CONDITIONS OF RESERVOIRS (IN GERMAN),
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia).
V. Sladecek, and L. Fiala.
Verh Internat Verein Limnol, XIV, p 619-624, Stuttgart, July 1961.

Descriptors: *Reservoirs, *Stratification, *Limnology, Hydroelectric power, Peak power, Plankton, Phytoplankton, Zooplankton, Epilimnion, Hypolimnion, Thermocline.

The influence of peaking power plant in east Bohemia caused a second transition zone in the Pastviuy reservoir during summer. Therefore, the hypolimnion was divided into two parts. The water from the upper part of the hypolimnion went to the turbines, while the water from the lower part of the hypolimnion was stagnant and mostly anaerobic. The epilimnion and part of the metalimnion were not influenced by peak operating conditions, and thus, biological observations showed that plankton in the reservoir were unaffected. The temperature, D.O. content, and number of plankton in the flow control basin were very low, which was caused by the water discharged from the hypolimnion. (Novotny-Vanderbilt)
W70-00293

BIOCHEMICAL EFFECTS OF COOLING WATER DISCHARGE INTO PUBLIC WATERS (IN DUTCH),
Instituut voor Gezondheidstechniek TNO, The Hague (Netherlands).
J. K. Baars.
De Ingenieur, No 51, p G85-G88, Dec 20, 1968. 3 fig.

Descriptors: *Thermal pollution, *Power plants, *Aquatic life, Ground-water, Nitrification, Oxygen sag, Oxygen requirements, Waste assimilative capacity, Biochemical oxygen demand, Respiration, Aeration, Kinetics.
Identifiers: Fenol.

Thermal pollution of a body of water, as being caused by the disposal of cooling water, has various aspects which under certain conditions can be detrimental to aquatic life. The influence of temperature on the oxygen content of water and its reaction rate with organic materials are major factors. The BOD reaction rate is generally considered to be 4% greater per 1 deg C increase in temperature. Modern power plants have only an efficiency of 33%. The rest of the heat will have to be disposed of. During the summer, as a result of thermal pollution, the oxygen content of the river Thames near Teddington is insufficient for normal aquatic life. Cooling towers can be used in which part of the water evaporates. This results in concentration of organic materials and nitrification, which again can be detrimental to fish life. High temperature increases the rate of breakdown of fenols. If ground-water is used it is generally necessary to add oxygen and remove Fe, H2S, and CO2 before disposal. (Rietveld-Vanderbilt)
W70-00303

PHYSICAL, CHEMICAL, BACTERIAL, AND PLANKTON DYNAMICS OF LAKE PONTCHARTRAIN, LOUISIANA,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 05B.
W70-00309

THE LIMNOBIOCHEMISTRY OF DEVILS LAKE, NORTH DAKOTA,
North Dakota Univ., Grand Forks.
Joe K. Neel, John W. Vennes, David W. Anderson, James D. Knauss, and Gary L. Buchli.
Completion Report, Sept, 1969. 18 p, 2 fig, 10 ref.

Descriptors: *Saline lakes, Limnology, Nitrogen, Phosphorus, Potassium, Sediments, *Plankton, *Benthos, Midges, Nekton, Salamanders, Bacteria.

Devils Lake, a highly mineralized remnant of a drying larger water body, has a high productivity that is enhanced by municipal wastes. Nitrogen and bicarbonate change with plankton growth and senescence, but this is not apparent for other nutrients. Nitrogen and phosphorus removed from water by phytoplankton are stored in and later released from bottom sediments. Potassium is more critical than nitrogen or phosphorus for algal growth. Sulfate reducing bacteria vary markedly on an annual basis with no significant changes in water chemistry, but nitrifiers and denitrifiers remain rather constant. Benthos m toto was most concentrated in areas with greatest phytoplankton productivity, but this was not true for several species. Midges are the major benthos component. Organic debris incorporated in sediments plays a minor role in benthos distribution. The three most numerous species were influenced by sediment particle size. Tiger salamanders are the most constant and largest nekton element, surviving sporadic oxygen depletions by having adults winter outside the lake. Neotenous forms are subject to 'winter kill', but are present most of the time, developing from eggs in one season. The role of neotenous forms in breeding and conditions governing their development are unknown. Salamanders suffer little predation.
W70-00311

EFFECT OF AN ACID-WATER ENVIRONMENT UPON THE SYNTHESIS OF GROWTH FACTORS (VITAMINS) BY BACTERIA,
West Virginia Center for Appalachian Studies and Development, Morgantown.
H. A. Wilson, and Keister L. Richardson, Jr.
OWRR Proj A-018-WVA. West Virginia Water Research Institute Information Report 1, 1969. 6 p, 9 ref.

Descriptors: *Acid mine water, Bacteria, *Acid bacteria, Water pollution sources, *Sewage bacteria.
Identifiers: *Bacteria growth, pH determinations.

Five bacterial isolates capable of growing in a synthetic medium with no vitamins or growth factors were used. Three of the isolates were obtained from Monongahela River water (an acid mine water-sewage polluted stream) and two from untreated domestic sewage. The minimum growth pH for two isolates was 3.7 and for the others it was 3.5. A synthetic medium was prepared, dispensed, and adjusted either to minimum growth pH or 0.2 unit below the minimum growth pH. To various portions of the medium amino acids, vitamins, fatty acids, peptone, yeast extract, soil extract, sterilized domestic sewage and a hydrolyzed protein were added singly and in combinations. Except for one combination of two additives, no increase in growth occurred at the minimum pH. With this combination better growth occurred at minimum pH level than in the control (no additives) with the five bacteria. There was some indication that one isolate growth was obtained in the presence of the additives at 0.2 pH unit below the previously determined minimum growth pH. pH determinations were made before and after medium modification, and before and after incubation to ensure no incorrect interpretations because of a pH shift.
W70-00312

STUDIES ON THE BLOOD MORPHOLOGY OF THREE ESTUARINE CYPRINODONTIFORM FISHES,
Federal Water Pollution Control Administration, West Kingston, R.I.
George R. Gardner, and Paul P. Yevich.
Journal of the Fisheries Research Board of Canada, Vol 26, 1969, p 433-447.

Descriptors: *Fish hematology, Hematology, *Morphology (Blood), Fundulus heteroclitus, *Estuarine fisheries, Estuarine environment.
Identifiers: *Blood cell morphology, Seasonal variation, Thrombocyte function, Stress indicators.

Specimens of Fundulus heteroclitus, Fundulus majalis, and Cyprinodon variegatus were bled in the field at the site of capture. Blood was obtained during all seasons and in the laboratory at intervals over a 30-day period from specimens held in two types of holding aquaria. The circulating blood elements of these three estuarine species consist of erythrocytes, small and medium lymphocytes, eosinophils, and thrombocytes. The observations were made using both stained and fresh blood preparations. Variations occurred seasonally in the morphology of erythrocytes, eosinophils, and thrombocytes. Cytoplasmic inclusions were visible in erythrocytes prior to, and at the beginning of, the new breeding season. There were changes in the refringent properties of thrombocytic and eosinophilic granules, and cyclic variations in the number of eosinophilic granules. Seasonal variations occurred in the ratio of immature to mature thrombocytes, but there was little overall variation in the ratios of leucocytic cell types. The thrombocytes were characterized by thrombocytic granulation and nuclear indentations. Thrombocytes were capable of altering their form; mature cells formed thrombocytic networks. The concentration of eosinophils gradually increased to 18% above the usual level in Fundulus heteroclitus held 30 days in 20-liter circular aquaria. The eosinophil level remained at the usual 2% specimens held in 189-liter aquaria for the same time period. Values for specimens captured in a natural environment were also 2%. It is therefore plausible to relate the rise in eosinophils with an environmental stress associated with the circular holding containers.
W70-00417

5D. Waste Treatment Processes

MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILLUTION,
Oklahoma Univ., Norman. Dept. of Civil Engineering and Sanitary Science.
George W. Reid, Leale E. Streebin, Robert Y. Nelson, and O. Tom Love.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, p 339-350, 1967. 12 p, 1 fig, 3 tab.

Descriptors: *Waste treatment, *Waste dilution, *Water quality control, *Optimization, Mathematical models, Systems analysis, Computer programs, Model studies, Costs, Economics, Streamflow, Water temperature, Biochemical oxygen demand.
Identifiers: Waste treatment-dilution optimization.

Models were developed to depict waste dilution flows used with projections of reservoir and treatment costs to provide optimal combinations of low flow augmentation and waste treatment. Projection of municipal and industrial loadings were developed on a nationwide data base using standard statistical methods. The study revealed mean and variances of strength and discharges. A similar study developed treatment efficiency matrices and corresponding treatment costs. These costs reflected scale effects, and were presented in terms of capital, operation, and maintenance costs. A novel technique employing micro and macro models and 'tunneling' procedure was used to disaggregate national values and to provide basin loading level forecasts. Stream input-output models were developed in terms of responses to impressed loads, characterized as biodegradable, nutritional, persistent chemical, and thermal. The models were developed as a function of stream parameters. The loads and stream resources were treated on a basin level in these macro level models. The model provides optimal or least cost combination of waste treatment and dilution. (Knapp-USGS)
W70-00064

CONTROL OF MINE DRAINAGE WATER,
Pennsylvania State Univ., University Park. Dept. of Mineral Preparation; and Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 05G.
W70-00069

ECONOMIC SIZING OF COOLING TOWERS,
Electricity Supply Board (Ireland).
A. G. Kelly, and N. R. Lawless.
Combustion, p 41-47, Aug 1962. 12 fig, 2 tab, 6 ref.

Descriptors: *Cooling towers, Weather charts, Thermal pollution, Thermal powerplants.
Identifiers: *Natural draft towers, Turbo-set heat consumption, Turbo-alternator efficiency, Cooling tower size, Weather analysis.

An accurate method of producing a weather specification for natural draft cooling towers is deduced. A size of cooling tower and condenser is chosen which will give the best value for money invested. The operating cooling water temperatures for every hour of the life of the plant are taken into consideration in the economics of choice of condenser and cooling tower. The analysis showed that the weather conditions are an effective 5 deg. to 7 deg. F more in favor of the tower than was heretofore thought. On first sight this might appear to make it economic to construct smaller cooling towers but, in fact, the opposite is true. Cooling towers give a good return in efficiency for extra investment; because towers are now known to produce colder water (and thus better heat consumption of the turbo-set) when actual average atmospheric conditions are fully analyzed, it is economic to build larger towers than heretofore. (Ross-Vanderbilt)
W70-00155

CONVECTIVE CIRCULATION IN WATER INDUCED BY EVAPORATIVE COOLING,
National Bureau of Standards, Washington, D.C.
For primary bibliographic entry see Field 02D.
W70-00156

USUAL APPLICATIONS OF COOLING TOWERS,
Foster Wheeler Corp., San Mateo, Calif.
J. J. Finnerty.
Industrial Water and Wastes, p 187-190, Nov-Dec, 1961. 5 fig, 1 ref.

Descriptors: *Cooling towers, *Thermal pollution, Waste water (Pollution), Heated water, Water reuse.
Identifiers: Counterflow cooling tower, Standby cooling tower, Salt water cooling.

That cooling towers efficiently and effectively conserve water while removing waste heat, both paramount objectives of industry is emphasized. Recent industrial expansion has created new and diverse cooling tower applications, three of which are described, all induced-draft counterflow cooling towers. In the first, salt water, rather than fresh, is cooled in the tower. The second tower, serving a condenser, in effect cools the river from which the circulating water is drawn. In the third application, the tower is used as a process instrument, removing excess heat from a waste flow to enable biological treatment. Details of these applications are given. (Ross-Vanderbilt)
W70-00157

COOLING WATER FOR STEAM ELECTRIC STATION ON TIDEWATER,
Southern California Edison Co., Los Angeles, Calif.
R. W. Spencer, and John Bruce.
Journal of the Power Division, Proceedings of the American Society of Civil Engineers, Vol 86, No PO 3, p 1-26, June 1960. 23 fig.

Descriptors: *Electric power plant, *Cooling water, *Tidewater, Thermal pollution, Calfiornia.
Identifiers: Steam electric station, Steam generating station.

A number of tidewater installations mostly in California are briefly reviewed in lieu of analysis of the detail of mechanical and hydraulic features of cooling water systems. Sites include: Mandalay, El Segundo, Long Beach, Redondo, Huntington Beach, Alamitos, Pittsburgh, Moss Landing, Morro Bay, Hunters Point, Contra Costa, Humboldt Bay, Encina (Carlsbad), Silvergate, Seal Beach, Los Angeles Harbor. Although the availability of cooling water has been a major factor in the selection of plant sites, the designer is usually faced with making a choice of several alternate cooling water arrangements after the site is purchased. There has been a steady improvement in the design of cooling water systems over the past 30 years. Desirable station sites are becoming difficult to obtain in many areas. A variety of methods have been used successfully in meeting operating problems encountered, such as sand movement, marine growth control, and fish destruction. (Ross-Vanderbilt)
W70-00159

SEA PLANTS FOR FOOD,
Southampton Univ. (England).
For primary bibliographic entry see Field 03C.
W70-00161

DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS.
American Water Works Association Research Foundation, New York.
For primary bibliographic entry see Field 05E.
W70-00162

ACTIVATED SLUDGE TREATMENT OF CHROME TANNERY WASTES, A Pilot Study of Treating Combined Chrome Tannery Wastes and Domestic Sewage.
Lawrence (A. C.) Leather Co., South Paris, Maine.

Available from the Clearinghouse as PB186 158. $3. in paper copy, .65 cents in microfiche. Water Pollution Control Series, FWPCA Report ORD-5, Sept 1969. 174 p, 48 tab, 36 fig, 13 ref, append. Grant No WPRD 133-01-68. FWPCA Program No 12120.

Descriptors: Pilot plants, Chromium, Sulfides, *Waste treatment, Industrial wastes, *Municipal wastes, Sludge, *Activated sludge.
Identifiers: *Tannery wastes.

The A. C. Lawrence Leather Company tannery at South Paris, Maine is a chrome side upper leather tannery. About 220 people are employed at the tannery and about 2,500 hides are processed each day. The water use at the tannery is about 1.0 mgd. Each day the waste discharged from the tannery contains about 8,500 lbs of 5-day, 20 deg C BOD, 70,000 lbs of total solids, of which about 17,000 lbs are suspended and 53,000 lbs are dissolved. The pH of the wastewater varies from 5.0 to 12.0. The daily waste discharge also contains about 8,000 lbs of calcium, as $CaCO_3$, 300 lbs of sulfides, and 1,800 lbs of chromium. A waste treatment process was developed and tested, in pilot plant scale, for the treatment of the tannery wastes in combination with municipal sewage. The process consisted of the following steps in the order employed; equalizing and mixing of the alkaline and acid wastes; primary sedimentation; carbonation followed by upflow sedimentation; addition of screened municipal sewage; activated sludge treatment and secondary sedimentation of the mixed wastes; and chlorination. The sludges resulting from the treatment of the wastes and sewage were dewatered by centrifuge and were found to be suitable for burial. Design factors for the various steps of the process were developed and are presented in the attached report. Studies were made of the fundamental systems and reactions which form the bases for the processes employed in the pilot plant. The results of the pilot plant investigation indicate that by use of the methods recommended, mixtures of chrome tannery wastes and municipal sewage can be treated successfully. It may be anticipated that by the employment of the methods recommended, that mixtures of tannery wastes and municipal sewage can be treated to remove more than 90 percent of the BOD and suspended solids together with about 65 percent of the total solids. Furthermore, the treatment will remove or convert 99 to 100 percent of the sulfides, remove about 97 percent of the chromium and about 65 percent of the calcium. Chlorination of the effluent will reduce the coliform bacteria concentration to less than 100 per 100 ml. The processes recommended are conventional sewage treatment unit processes, with the exception of carbonation and solids contact sedimentation. Modification of conventional equipment will be necessary to accommodate the special characteristics of tannery wastes. Fine screening will be needed to remove hair. Calcium carbonate incrustation of equipment, especially screens and carbonation equipment, will have to be considered. Extra strength sludge collection and pumping equipment will be needed since the sludges are large in quantity and are denser than sewage sludges.
W70-00163

RECOVERING THE KINETIC ENERGY OF A FALLING LIQUID IN A COOLING TOWER,
Central Electricity Generating Board, London (England). Central Electricity Research Labs.
L. O. Wild.
CEGB Technical Disclosure Bulletin, No 41, Nov, 1964. 3 p, 3 fig.

Descriptors: *Cooling towers.
Identifiers: *Kinetic energy, Velocity component.

This report is based on the work carried out at CEGB, U. K. on the recovery of energy from cooling towers and is useful for typical large cooling towers where water might have to fall 30 feet. If the liquid from a cooling tower is allowed to fall onto a flat surface, all the kinetic energy is dissipated as heat. If a cone is used in place of a flat surface the liquid will run down the surface in radially outward direction and could be collected in a culvert around the base of the cone, but the acquired kinetic energy would be destroyed against the wall of the cone. If the cone is modified so that the semi-angle of the cone is gradually increased as one goes round the surface of the cone then at any point the line of greatest slope is no longer radial but has a circumferential component. The culvert would have a slope and cross-section to suit the flow and velocity required. To maximize circumferential component of velocity the apex of the cone would preferably be at the maximum possible height. (Upadhyaya-Vanderbilt)
W70-00316

REDUCED PUMP HEAD CROSSFLOW COOLING TOWERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
D. G. Christie.
CEGB, Technical Disclosure Bulletin, No 106, May, 1968. 3 p, 1 fig.

Descriptors: *Cooling towers.
Identifiers: *Crossflow cooling tower, *Pump head, Thermal design, Pump power.

It is shown that by splitting the packing of a cross flow cooling tower into two sections vertically one above the other, a saving of up to 40% of the tower pumping head can be achieved. It is shown that required pump power in case packing is (40+ Y1+ 1/2 H) W. ft lb/hr and the corresponding value for the single packing is (40+ Y2) W. ft lb/hr. Y2 and Y1 are the height of the tower in non-splitting and splitting the packing, H is head (2-3 ft) required to allow for the flow resistance in downcomer from the upper packing and W is the total water flow in lb/hr through the tower. Taking practical values of 66 and 37 ft. for Y2 and Y1, the saving in pumping head for the split pack tower is 28 ft. The overall packing height must be increased to maintain the thermal performance, but the capital cost of the tower is substantially the same since a thinner packing is technically acceptable. (Upadhyaya-Vanderbilt)
W70-00320

STATUS OF BIG COOLING TOWERS,
Marley Co.
For primary bibliographic entry see Field 08A.
W70-00321

5E. Ultimate Disposal of Wastes

EVALUATING SANITARY LANDFILL SITES IN ILLINOIS,
Illinois State Geological Survey, Urbana.
Keros Cartwright, and Frank B. Sherman.
Ill State Geol Surv Environ Geol Note No 27, Aug 1969. 15 p, 3 fig, 13 ref.

Descriptors: *Landfills, *Environmental sanitation, *Illinois, *Hydrogeology, Sanitary engineering, Waste disposal, Geology, Groundwater movement, Surface waters, Glacial drift, Aquifers, Aquicludes.
Identifiers: Illinois sanitary landfills.

Criteria for the suitability of sites for sanitary landfill in Illinois are listed and discussed. Both surface water and groundwater must be protected from leachates containing large organic and bacterial loads. Landfills should be located in relatively impermeable material so that leachate movement is retarded. Clay, shale, silt, and glacial till are the most common materials with low permeability in Illinois. At least 30 ft of impermeable material is required between the bottom of a landfill and the shallowest aquifer. Choice of proper site topography is important in avoiding surface drainage contamination. Limestone or dolomite quarries and most sand and gravel pits make poor landfill sites because these materials are usually good aquifers. Swampy areas also make poor sites unless they are properly drained to prevent disposal into standing water. Strip mines, clay pits, and gravel pits containing gravel with a high percentage of natural clay binder (the type that is often used for grading county roads) do make good disposal sites if kept dry. Flat upland areas also are good potential sites if the required natural clay barrier is present above any aquifer. The careful selection of a landfill site will result in a minimum of operating problems and little, if any, danger of groundwater or surfacewater pollution. (Knapp-USGS)
W70-00006

POLLUTION OF STREAMS--SEWAGE DISPOSAL PLANTS.
For primary bibliographic entry see Field 05G.
W70-00093

DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS.
American Water Works Association Research Foundation, New York.

Available from the Clearinghouse as PB186 157, $3. in paper copy, .65 cents in microfiche. Water Pollution Control Series, FWPCA Report ORD-2, Aug, 1969. 184 p, 7 tab, 30 fig, 195 ref, subject index. Project No WP1535-01-69. FWPCA Program No 12120 ERC.

Descriptors: *Waste disposal, Waste treatment, *Water treatment, Sludge treatment, Ultimate disposal, Operation and maintenance, *Cost analysis, Regulation, Surveys, *Utilities, Water works.

This report is an intensive study of the disposal of wastes from water treatment plants. The wastes include filter washwater; sludge resulting from coagulation, softening, iron and manganese removal processes; diatomaceous earth filtration; and ion exchange brines. The control of pollution from these wastes is a high priority problem for the water utility industry. A series of four status reports describe in detail what is known of the research, engineering, plant operation, and regulatory aspects of the problem. A special report reviews current technology and analyzes costs of disposal methods, based on data collected from fifteen operating plants. A conference was organized to provide expert evaluation of each report and to extend the data available. Final reports were prepared by committees of conference participants to identify future needs for information in each aspect of the waste disposal problem. These reports recommend substantially expanded programs of research and demonstration. They include extensive lists of specific problems which must be investigated to develop effective and economical technology. Committee reports also recommend establishment of a central service to promote the planning of research and development, and to implement effective programs of new or improved technology. The service would collect, coordinate, and disseminate data on all aspects of water treatment plant waste disposal problems.
W70-00162

CITY OF MARYVILLE V CUSHMAN (RIGHT TO CHARGE FOR SEWAGE DISPOSAL).
249 SW2d 347-356 (Mo 1952).

Descriptors: *Missouri, *Local governments, *Water rates, *Waterworks, Sewage disposal, Sewerage, Utilities, Sewers, State governments, Judicial decisions, Remedies, Legal aspects, Financing.

Pursuant to the authority granted by an act of the Missouri legislature, the city of Maryville combined its waterworks and sewerage systems. In a special election, it chose to issue and sell revenue bonds to defray the cost of improving and extending this combined system. The bonds and interest were to be paid out of the funds collected for the use of the combined system. A group of taxpayers, water users and sewer users filed a petition praying that the bonds be held invalid. Following a decree finding the bonds valid, they appealed. The court affirmed this decree. It held: (1) that respondent could charge for the use of the sewerage system regardless of whether such system had previously been maintained through taxes; (2) that respondent could legally make an owner liable for the water and sewerage services rendered to a tenant on the owner's premises; and (3) that respondent was authorized to discontinue water service upon a failure to pay the fixed charges within a reasonable time. (Gabrielson-Florida)
W70-00382

NORTH SUBURBAN SANITARY SEWER DISTRICT V WATER POLLUTION CONTROL COMM'N (WATER POLLUTION CONTROL STANDARDS).
For primary bibliographic entry see Field 05G.
W70-00397

5F. Water Treatment and Quality Alteration

OCEAN COOLING WATER SYSTEMS FOR TWO THERMAL PLANTS,
Department of Water and Power, Los Angeles, Calif.
L. T. Mariner, and W. A. Hunsucker.
Journal of Power Division, Proceedings of the American Society of Civil Engineers, Vol 85, No PO 4, Aug 1959. 21 fig.

Descriptors: *Thermal power plants, *Cooling water, Design, Construction, Dewatering, Flood protection, Fish repellent.
Identifiers: Los Angeles, Scattergood Steam Plant, Haynes Steam Plant.

Varied problems are compared associated with the design and construction of circulating water facilities for two coastal themal plants to serve the city of Los Angeles. Widely differing locations pose diverse design problems of sanding, erosion, and navigational requirements. Construction dewatering problems are illustrated and discussed. The Scattergood Steam Plant on Santa Monica Bay and the Haynes Steam Plant are compared. The circulating water system for the Scattergood Cooling Plant is designed for cooling the first four power units. Although space is provided for a six-unit plant, it is estimated that there will be major changes in the design of thermal generating units before the last two are required. At the Haynes Plant cooling water will pass through substructures under the San Gabriel River and Pacific Coast Highway into an open channel leading to the plant site. Integrated screening and pumping facilities for the ultimate development are not contemplated for this plant. Each unit or pair of units will have a separate installation for this purpose. (Ross-Vanderbilt)
W70-00160

COMMUNITIES OF OVER 1000 POPULATION WITH WATER CONTAINING IN EXCESS OF 1000 PPM OF TOTAL DISSOLVED SOLIDS.
Black and Veatch, Kansas City, Mo.

Office of Saline Water Research and Development Progress Report No 462, October 1969. 49 p. OSW Contract 14-01-0001-1777.

Descriptors: Chemical analysis, *Water quality, *Municipal water, Domestic water, *Public health.
Identifiers: Substandard quality water supplies, *Total dissolved solids.

The report presents listings by states and by water resource regions of the community water systems, 420 in number for the United States, having reported water supplies with high mineral content. The listings are restricted to communities of population 1,000 or over, and to supplies containing 1000 ppm of TDS or over. For 284 of the communities, all sources feeding into the water supply have over 1000 ppm of TDS. The 420 communities listed represent a 1960 population in excess of 2,770,000. (Bovet-Office of Saline Water)
W70-00308

5G. Water Quality Control

CONTROL OF MINE DRAINAGE WATER,
Pennsylvania State Univ., University Park. Dept. of Mineral Preparation; and Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Harold L. Lovell, and Bruce E. Jones.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 578-587, 1967. 10 p, 4 fig, 2 tab.

Descriptors: *Acid Mine water, *Water pollution control, Waste water treatment, Neutralization, Ion exchange, Biodegradation, Oxidation, Water pollution treatment, Abatement, Water quality control, Pilot plants.
Identifiers: Acid mine drainage control.

Coal mine drainage creates a stream contamination problem which currently plagues several eastern states. It introduces iron, aluminum, and sulfate ions as well as sulfuric acid into receiving streams and frequently produces unsightly sediments on stream bottoms. These constitute an environment which is generally incompatible with aquatic life, recreational use, and industrial water requirements. Such pollution develops naturally under proper environmental conditions but is enhanced by mining operations. Recently adopted state laws and regulations require immediate and extensive remedial action in certain areas. Corrective approaches to these pollution conditions include prevention of its formation, amerioration, diversion to areas where the contamination might be less innocuous and water treatment for removal of the contaminants. At the present time, one of the approaches being taken by the Pennsylvania State University is the construction of a versatile experimental plant for treating such waters. This plant will be capable of treating half a million gallons of water per day and will utilize 6 separate neutralization flow paths. Such data are essential to obtain the economic information for optimizing design and operational procedures. (Knapp-USGS)
W70-00069

POLLUTION CONTROL AMENDMENTS URGED.

Am Forests, Vol 62, No 1, p 23, Jan 1956. 1 p.

Descriptors: *Pollution abatement, *Water pollution control, *Legislation, *Federal government, Conservation, Policy, Water quality control, Natural resources, Water pollution, Public benefits, Administrative agencies.

In December 1955, a meeting was held by the National Wildlife Federation in order to promote the extention and revision of the federal Water Pollution Control Act. Members of the Natural Resources Council asked the Department of Health, Education, and Welfare to give this bill its full and undivided attention. The group also asked the Department to resist any efforts to weaken the bill as pending. (Heckerling-Florida)
W70-00086

POLLUTION OF STREAMS--SEWAGE DISPOSAL PLANTS.
Ind Ann Stat sec 48-4207 (1963).

Descriptors: *Indiana, *Pollution abatement, *Sewerage, *Pollutant identification, Legislation, Legal aspects, Streams, Sewage disposal, Cities, Rivers, Drainage, Watercourses (Legal), Drainage systems, Public health, Public benefits, Structures, Pumping plants, Specifications, Right-of-way, Investigations, Construction, Financing, Drains, Sewers, Environmental sanitation, Water pollution, Waste disposal, Sanitary engineering.
Identifiers: *Sewage disposal plants.

When the Board of Sanitation Commissioners of any city located on or near any watercourse finds upon investigation that such watercourse is being polluted by sewage or drainage system discharge from such city, it must determine whether the construction of a sewage disposal system is necessary for the public health and benefit. If a new disposal system is deemed necessary, the board prepares maps, plans, specifications, and drawings for the proposed plant together with an estimate of the installation costs of the plant and all structures incident thereto. The board must also prepare a description of all property rights to be acquired in connection with such plant whether such rights are to be obtained by purchase or appropriation. The board must then propose a resolution incorporating the findings of its original investigation as well as all pertinent maps, plans, specifications, and descriptions. The procedures for adoption of the resolution, financing the plant, having public hearings on the resolution, and acquiring the necessary property are all specifically set out. (Keith-Florida)
W70-00093

INTERSTATE WATER SANITATION BOARD.

Ky Rev Stat Ann secs 224.205, 224.210 (Supp 1968).

Descriptors: *Kentucky, *Interstate compacts, *Water pollution control, *Interstate commissions, Legislation, Basins, Rivers, Interstate rivers, Ohio River, Administrative agencies, Legal aspects.
Identifiers: *Water sanitation.

An Interstate Water Sanitation Board is established. The members of the Board shall serve as Kentucky's members of interstate water sanitation control commissions created by compacts to which Kentucky is a party, which compacts are composed of states forming a river basin, and which compacts require a three-member representation from each state. The interstate water sanitation control commissions created by such compacts shall have all the powers provided for in the respective compacts, and all the powers necessary or incidental to the carrying out of the compacts in every particular. Any powers granted to the commissions by this section shall be regarded as in aid of and supplimental to and not as a limitation upon any of the powers vested in the commissions by other laws of this state or by the laws of any of the states party to any of the compacts, or by Congress, or by the terms of the compacts. (Heckerling-Florida)
W70-00107

DUTIES OF THE DEPARTMENT OF CONSERVATION.

Ind Ann Stat secs 60-718 thru 60-720 (1962).

Descriptors: *Water conservation, *Indiana, *Wildlife conservation, *Water pollution control, Legislation, Legal aspects, Drainage, Eminent domain, Lakes, Streams, Springs, Water pollution, Sewage disposal, Regulation, Administrative agencies, Conservation, Navigable waters, Fish, Permits, Beds, Public health, Public utilities, Riparian rights, Riparian land, Right-of-way, Parks, Fish management, Fish conservation, Fish reproduction.
Identifiers: *Penalties (Criminal).

The duties of the department of conservation are: to employ convicts for the purpose of draining lands acquired by the state for parks; to investigate lakes, streams, and springs for the presence of pollution and to prevent further pollution by the promulgation of necessary regulations; to have general charge and supervision of the navigable waters of the state; and to issue permits for the taking of minerals from or under the bed of any of the navigable waters of the state when the operations under such permit will not impede navigation or endanger any public structures or the property of any riparian owner. All lands owned by the state which are adjacent to any lake or stream are placed under the control and management of the department of conservation, except that the state reserves the right to convey rights of way to public utilities. The division of fish and game has the following duties: examination, testing, and carrying out methods for fish and game reproduction; acquisition or construction of equipment for the foregoing duty; and enforcement of wildlife protection laws. (Keith-Florida)
W70-00135

SOME ASPECTS OF THE PROBLEM OF MIXING OF POLLUTED WATER AND SELF-PURIFICATION OF STREAMS (IN RUSSIAN).
Gosudarjtvennyi Geologicheskii Institut, Leningrad (USSR).
A. V. Karaushev.
Materialy po voprosam samoochishcheniya vodoyomov i smeshcheniya stochnikh vod, Tallinn Pol Inst, p 5-27, June 7-10, 1965. 24 ref.

Descriptors: *Turbulence, *Mixing, *Waste dilution, Water pollution, Mathematical models, Hydraulic models, Mass transfer, Waste water (Pollution).
Identifiers: Turbulent mixing coefficient, Wind effect.

Applicability of sediment movement laws to the problems of waste dilution in streams is discussed and a new approach developed. The solution to the waste dilution problems is based on Makkareev's formula of turbulent diffusion in streams. Including wind effect in computation of the turbulent mixing coefficient for reservoirs and lakes is proposed, and an analytical approach presented. Uses of hydraulic models and problems of model similarity for dilution of waste waters in streams are discussed in the end of the paper. (Novotny-Vanderbilt)
W70-00151

PANTHER COAL CO V LOONEY (MINE WATER POLLUTION).

185 Va 758, 40 SE2d 298-305 (1946).

Descriptors: *Virginia, *Acid mine water, *Riparian rights, *Water pollution, Judicial decisions, Acidity, Corrosion, Water pollution effects, Coal mine wastes, Effluents, Mine acids, Mine wastes, Water pollution sources, Reasonable use, Water rights, Riparian land, Acid streams, Mine drainage, Percolating water, Water law.

Plaintiff is lower riparian land owner. Defendant coal company mines upper land upon which the stream flowing through plaintiff's land arises. Seeping and percolating mine water flows naturally into the stream. The mine water contained acids and minerals sufficient to injure and kill vegetation. Plaintiff claims that the stream and water wells located on his land were damaged. An upper riparian owner does not have a legal right to pollute to a material degree the stream running through a lower owner's land. The lower owner has a cause of action only when an unreasonable use of land and water by the upper land owner renders the water flowing into his land unfit for the use for which it had once been suitable and actually put. The court found the defendant not liable because the plaintiff had caused stream pollution himself and was unable to prove what proportion of the pollution was attributable to defendant. (Helwig-Florida)
W70-00167

WATER POLLUTION CONTROL.
Vt Stat Ann Tit 10, secs 901-918 (1958), as amended, (Supp 1968).

Descriptors: *Vermont, *Water pollution, *Water pollution control, *Classification, Legislation, Legal aspects, Recreation, Irrigation, Navigation, Pollution abatement, Reservoirs, Water resources, Permits, Water quality, Drainage, Cities, Rivers, Streams, Ponds, Lakes, Springs, Surface waters, Swimming, Watersheds (Basins), Water utilization, Sewage, Water supply.
Identifiers: Agricultural uses, Penalties (Criminal).

'Pollution' is the placing in the waters of the state of any noxious or deleterious substance which is likely to create a nuisance or which renders such waters harmful to animal or aquatic life or unfit for domestic, commercial, industrial, or recreational uses. The terms 'waters' includes artificial and natural bodies of surface water within the state. Water is classified as follows: class A water is suitable for public supply with disinfection and is of uniformly excellent character; class B water is suitable for bathing, recreation, irrigation, agricultural uses, and is acceptable for public supply with filtration and disinfection; class C water is suitable for recreational boating, wildlife habitat, and other specified uses; and class D water is suitable for power, navigation, transportation of sewage, and other specified uses. To implement compliance with the New England Interstate Water Pollution Control Compact and to effectuate a program for the prevention, control, and abatement of pollution, it is specified which state waters fall into each of the foregoing categories. A permit is required to create or maintain a source of pollution. The manner of the regulation, administration, and enforcement of the classification system is specified. (Keith-Florida)
W70-00168

CHICAGO SANITARY DISTRICT.

Ill Ann Stat ch 42, secs 326, 326aa, 326bb, 329a, 330, 336, 337, 339, 341, 342, 344-349, 351, 352, 354-359 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Sewage treatment, *Drainage systems, *Water pollution, Legislation, Administration, Administrative agencies, Drainage, Municipal wastes, Sewage disposal, Cities, Pollution abatement, Treatment facilities, Channels, Channel improvement, Engineering structures, Sewage, Waste water (Pollution), Assessments, Water resources, Eminent domain, Flood control, Regulation, Permits, Water control.
Identifiers: *Sanitary districts.

The authority of sanitary districts includes jurisdiction over drainage, sewage, and treatment works within their respective territories. Districts are charged with prevention and abatement of pollution by establishing standards, requiring permits for construction of municipal sewage systems and for changed systems, and initiating court action against violators. Financing of projects may be through sale of bonds. Authority of districts includes building docks, highways, bridges, approaches, and other works related to drainage canals and channels, and existing waterways may be improved to facilitate drainage. Districts have the power of eminent domain in most instances and are held liable for all damage caused by improvements. Specifications are made for size and capacity of sewage and drainage watercourses, for restrictions on the type of sewage discharge allowed, and for connecting facilities between districts. Districts which violate the act are subject to court action initiated by the Attorney General. Municipalities are required to share water sources that have been saved from pollution with other cities. There is provision for inspection of new channels. The city of Chicago is organized as a drainage district, and the statutory powers are conferred on the corporate authorities. (Douberley-Florida)
W70-00171

CHICAGO SANITARY DISTRICT.

Ill Ann Stat ch 42, secs 326, 326aa, 326bb (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Sewage treatment, *Drainage, *Sewage disposal, *Pollution abatement, Sewage, Sewage effluents, Waste water (Pollution), Surface drainage, Sewers, Regulation, Permits, Water control, Wastes, Municipal wastes, Waste water disposal, Waste water treatment, Cities, Docks, Water pollution, Water pollution treatment, Impaired water quality, Pollutant identification, Standards, Treatment facilities, Water quality.
Identifiers: *Sanitary districts.

Sanitary district trustees provide for drainage of surface water and sewage as well as for sewage disposal and treatment works. They also establish docks adjacent to navigable drainage channels, establish rates and charges therefore, and control water power which is incidentally created in the construction and use of channels, but do not control water after it passes the district's facilities. The Board of Trustees may prevent pollution of any source of water supply by mandamus or injunction proceedings. The Board may require municipalities to submit plans and specifications for approval before construction of sewers connecting with those of the district. The Board of Trustees determines what discharges constitute pollution and establishes standards within those set by the Sanitary Water Board. The Board has a duty to determine ways and means of removing and abating pollution. A permit from the Board is required for installation of any sewage system that discharges wastes into district waters and for changes in systems of large municipalities. When pollution occurs the Board may order discharge discontinued after notice and hearing. (Douberley-Florida)
W70-00172

CHICAGO SANITARY DISTRICT.

Ill Ann Stat ch 42, secs 329a, 330, 336, 337, 339 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Sewage disposal, *Engineering structures, *Drainage systems, *Sewage, Drainage, Sewers, Financing, Docks, Channels, Canals, Condemnation, Eminent domain, Condemnation value, Right-of-way, Channel improvement, Drainage water, Treatment facilities, Bridges, Cities, Compensation, Highways.

Sanitary districts may construct or improve sewage or drainage systems in a particular locality and finance the improvements through the sale of bonds. Specifications are provided for issuance of bonds. Districts may build and maintain highways along canals and channels where it is necessary to make dock property owned by the district accessible for use. These highways may be conveyed or released to the state. After proper proceedings, districts may condemn and acquire private property which is necessary to make improvements authorized by this chapter. Districts may acquire rights-of-way over public property and may improve any waterway, canal, lake, or other waters, including straightening of watercourses used for drainage. Plans for improvements must be approved by the Department of Public Works and Buildings. Districts may acquire existing sanitary facilities, but only by means other than condemnation. Provisions are made for bridges over certain channels, approaches, viaducts, subways, roadways, and sidewalks. These structures are to be turned over to municipalities if within their corporate limits. Districts are liable for any damage caused by any improvements, provided the district concerned is notified prior to suit. (Douberley-Florida)
W70-00173

CHICAGO SANITARY DISTRICT.

Ill Ann Stat ch 42, secs 341, 342, 344-347 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Channel improvement, *Drainage systems, *Waste water (Pollution), Channel flow, Drainage, Drainage practices, Sewage, Channels, Navigation, Navigable waters, Regulation, Sewers, Waste water disposal, Impaired water quality, Assessments, Taxes, River flow, River regulation.

Any channel or outlet discharging sewage into waters outside the sanitary district which constructed it must be of a specified size and capacity. Discharges must be such that the waters will be free of solids and will not be offensive or injurious to health. The Attorney General may institute suit against any district not complying with the act. Districts may levy an emergency tax if necessary to comply with improvements or changes decreed by the court. Minimum capacity is set for channels that divert Lake Michigan waters into various rivers, and districts have authority to remove obstructions in those rivers to prevent overflowing. Existing power rights are not affected. Channels are under the control of the general government for navigational purposes. Any district may provide for works in the Great Lakes or in connecting watercourses outside its territory for purposes of complying with the act. Districts may agree on terms and conditions for drainage from outside territories into its channels and for use of outside drains or channels. Specifications are established for the united flow from two districts. (Douberley-Florida)
W70-00174

CHICAGO SANITARY DISTRICT.

Ill Ann Stat ch 42, secs 348, 349, 351, 352, 354-359 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Channel improvement, *Flood control, *Drainage systems, *Water control, Cities, Costs, Cost-benefit theory, Cost allocation, Water quality, Water resources, Water supply, Channels, Inspection, On-site investigations, Testing, Condemnation, Eminent domain, Bridges, Cutoffs, Flood routing, Dams, Diversion structures, Water pollution treatment, Right-of-way, Maintenance.

Any municipality whose water source will be saved from pollution by construction of facilities under this act shall provide water to other municipalities as needed at the same rates charged other customers, unless facilities must be built outside its corporate limits and a higher rate is justified. No water or sewage may be admitted to a newly constructed channel before a board of commissioners certifies it to be in accordance with the provisions of this act. Sanitary districts may acquire land by purchase or eminent domain for the widening and deepening of streams which are to be used as channels. Bridges may be constructed where made necessary by such improvements. The City of Chicago is organized as a sanitary district, and the powers conferred by the act are conferred on the corporate authorities. They are authorized to construct a cut-off drain to divert flood water into Lake Michigan and to construct certain dams. Corporate authorities have the power to acquire property and rights-of-way necessary for the maintenance of authorized works. Cost of improvements is defrayed by assessing property within the district that is benefitted by the improvement. (Douberley-Florida)
W70-00175

STRIP MINING.

Ky Rev Stat Ann secs 350.020, 350.050, 350.060, 350.085, 350.090, 350.093, 350.100, 350.170, 350.240, 350.990 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Strip mines, *Mine drainage, *Strip mine wastes, Acid mine water, Cooling water, Fouling, Impaired water quality, Landfills, Mining, Pollutants, Public health, Soil contamination, Waste water, Water pollution sources, Water pollution effects, Seepage, Erosion, Sedimentation, Soil conservation, Drainage systems, Erosion control, Flood protection, Pollution abatement, Permits, Legislation.
Identifiers: *Anti-pollution legislation, Mining regulations, Penalties (Civil), Penalties (Criminal).

A Reclamation Commission was created to rigidly enforce regulation of and supervision of strip mining after findings that unregulated strip mining of coal counteracts efforts for soil and water conservation and causes erosion, pollution, and flooding. The Commission is given broad discretionary power to investigate, research, inspect, and rule upon issues created in this chapter. Permits are made necessary for strip mining in the state and applications for such permits must include a map of the course to be taken by drainage from the mine. If the mining project constitutes a hazard to streams or lakes in the area or is within one hundred feet of any public stream or lake, the permit will be denied. A proposed reclamation plan, including measures to eliminate damages to public property from erosion, pollution, and flooding, must be submitted and carried out by complete backfilling within twelve months after the permit has expired. These same requirements may be adopted for the mining of clay. Penalties, both civil and criminal, are proposed for any violation of the provisions of this chapter. (Schram-Florida)
W70-00177

TENNESSEE RIVER BASIN WATER POLLUTION CONTROL COMPACT.

Ky Rev Stat Ann sec 224.195, 224.200 (Supp 1968).

Descriptors: *Water pollution, *Kentucky, *Interstate compacts, *Tennessee River, Rivers, Water pollution control, Pollution abatement, River basin commissions, Administration, Administrative agencies, Legislation, Legal aspects, Governments, State governments, Water treatment, Standards, Water quality, Water pollution, Regulation, Sewage treatment, Water utilization.

The purpose of this compact is to promote effective control and reduction of pollution in the waters of the Tennessee River Basin through increased interstate cooperation. A district consisting of the area drained by the Tennessee River is created and a commission is established to manage, plan, inspect, render advise, and draft legislation concerning pollution in the river basin. The Commission shall prescribe regulations designed to further this compact. Although no single standard for sewage treatment or water quality will be appropriate for all situations, the Commission shall establish those standards that are best suited to the area involved

and the use of the water. The individual member states will work to establish water treatment programs designed to meet these standards. Also, any state pollution control agency may certify to the commission an alleged violation of the existing standards. After hearing, the Commission shall recommend appropriate measures to the state agency. If the violation does not cease, then the Commission holds further hearings and may order compliance with their findings. These orders may be enforced in the appropriate courts by specific relief suits. (Darragh-Florida)
W70-00178

TORTS - NUISANCE: INTERESTS WHICH WILL SUSTAIN A NUISANCE ACTION,
B. E. Ross.
Ark L Rev, Vol 19, No 3, p 407-409, Fall 1966. 3 p, 28 ref.

Descriptors: *Arkansas, *Riparian rights, *Water pollution, *Commercial fishing, Judicial decisions, Water users, Pollution abatement, Remedies, Damages, Streams, Non-navigable waters, Fishkill, Land tenure, Water pollution sources, Water pollution effects, Water pollution control.
Identifiers: *Nuisance (Public), *Nuisance (Private).

In Carson v Hercules Powder Co, 402 S.W. 2d 640 (1966), plaintiff, a commercial fisherman, had permission from the riparian owners to fish along a non-navigable stream. It was established that defendant polluted the stream, killing the fish, and preventing plaintiff from continuing his fishing. The Arkansas Pollution Control Commission had previously found defendant's pollution to be a public nuisance and had enjoined further pollution. Plaintiff asked for damages and injunctive relief. The trial court held testimony insufficient to justify an injunction and denied damages. The appellate court reversed and remanded, holding plaintiff entitled to damages for loss of earnings and damages to his business. The problem in this case concerns the types of interests which will sustain an action for nuisance. Unless the plaintiff has some interest in the property affected, he may not prevail in a private nuisance action. Any interest which can be deemed a property right will support the action. The action in the principal case might have been sustained on either a private nuisance or private action for a public nuisance theory. The court apparently adopted the plaintiff's contention that he was a tenant at the will of the riparian owners, and therefore had the requisite possessory interest to sustain the action. (Heckerling-Florida)
W70-00181

RIVERS STREAMS AND WATERWAYS.

Ind Ann Stat sec 48-5511 (1963).

Descriptors: *Local governments, *Administrative agencies, *Parks, *Indiana, Maintenance, Rivers, Streams, Assessments, Legislation, Bridges, Tunnels, Bank protection, Levees, Flow control, Pollution abatement, Water pollution control.

The Board of Park Commissioners of any city shall have the power to keep open and clean rivers and streams bordering on or running through any public park. They may improve the banks of such waters, build levees, control water flow, and promulgate rules and regulations required for such purposes. They may construct all necessary bridges over or tunnels under such waters within public parks. Owners of real estate abutting such waters may be required to maintain the waters free of objectionable pollutants. If such owners fail to comply, the Board may cause such objectionable materials to be removed, and upon certification of such removal the county treasurer shall assess the cost to the property owner. (Darragh-Florida)
W70-00186

GROUNDWATER STUDIES--CHICAGOLAND DEEP TUNNEL SYSTEM,
Harza Engineering Co., Chicago, Ill. Water Resources Planning Div.; and Metropolitan Sanitary District of Greater Chicago.
Istavros S. Papadopulos, William R. Larsen, and Forrest C. Neil.
Ground Water, Vol 7, No 5, p 3-15, Sept-Oct 1969. 13 p, 16 fig, 4 tab, 10 ref.

Descriptors: *Water storage, *Hydrogeology, *Storm runoff, *Cities, *Illinois, Waste water treatment, Waste water disposal, Groundwater, Water levels, Seepage, Discharge (Water), Hydrologic data, Aquifers, Pumped storage, Analog models.
Identifiers: *Chicago Deep Tunnel Plan.

The Deep Tunnel System planned by the Metropolitan Sanitary District of Greater Chicago will provide flood and pollution control for the combined sewer areas of the Chicago region. Elements of the Deep Tunnel System that are of main concern to the groundwater resources of the area are the conveyance tunnels and the mined storage reservoir which will convey and store polluted storm-water overflows. The Silurian and the Cambrian-Ordovician aquifers, in units of which these elements will be located, will be protected from any deleterious effects of the System by ensuring that a positive hydraulic head, causing an inward flow, is continuously maintained around the tunnels and the mined reservoir. In the Cambrian-Ordovician aquifer, this necessitates that groundwater levels are maintained by artificial recharge. Extensive groundwater studies were conducted to (1) demonstrate the feasibility of aquifer protection by recharge, (2) determine the needed amounts of recharge water, and (3) estimate the seepage of groundwater into the tunnels and mined reservoir. The studies included field investigations, analog computer analyses and office evaluation of the collected data and analog results. The results indicate (1) the proposed aquifer protection is feasible, (2) the recharge requirements will vary from 1.4 mgd in 1976 to 6.0 mgd in 2010, (3) seepage into the tunnels will be small, in amounts that can be easily controlled. (Knapp-USGS)
W70-00205

LAKE MICHIGAN POLLUTION AND CHICAGO'S SUPPLY,
Department of Water and Sewers, Chicago, Ill.
For primary bibliographic entry see Field 05B.
W70-00263

AMMONIA NITROGEN LOSSES FROM STREAMS,
San Diego State Coll., Calif. Dept. of Civil Engineering.
Frank E. Stratton.
J of Sanitary Engineering Div, Proceedings of American Society of Civil Engineers, Vol 94, No SA6, p 1085-1092, Dec 1968. Proc Paper No 6282. 2 fig, 4 tab, 7 ref.

Descriptors: *Ammonia, *Nitrogen cycle, *Streams, Eutrophication, Water treatment, Turbulent flow, Water pollution control, Recirculated water, Water quality, Reclamation.
Identifiers: *Ammonia-nitrogen.

The loss of ammonia gas to the atmosphere due to surface turbulence may account for a significant quantity of ammonia-nitrogen losses from streams and rivers. A recirculating flume with a simulated river bed was used to determine the ammonia loss rate constant for a synthetic river water containing dissolved ammonium. Rate constants (per hour), k, at pH8, vary with temperature according to the relationship, k= 0.048 exp (0.13 (T-20)), where T is temperature (degrees Celsius). At 20 deg C, k varies with pH according to the relationship, k= 0.080 exp (1.57 (pH - 8.5)). According to these data, concentration of ammonia-nitrogen would be reduced 50% in 10.8 hours and 7.4 miles at T=20, pH=8.5; in 0.6 hours and 0.4 miles at T= 30, pH= 9.5. (Jacobs-Wisconsin)
W70-00267

THE CONTROL OF WATER WEEDS.
Agricultural Research Council, Kidlington (England). Weed Research Organization.
E. C. S. Little.
Weed Research, Vol 8, No 2, p 79-105, 1968. 363 ref.

Descriptors: *Aquatic weeds, *Aquatic plants, *Aquatic weed control, Water conservation, Water control, Fertilizers, Sewage effluent, Nutrients, Lakes, Channels, Reviews, Bibliographies, Herbicides, Fish, Fresh water, Algae, Ponds, Water hyacinth, Chemical controls, Paraquat, Diquat, Sodium arsenite, Copper sulphate, Monuron, Ammonia, Dalapon, 2-4-5-T Ureas, Seeds, Proteins, Microorganisms, Fermentation, Surfactants, Floating plants, Ferns, Alligatorweed, Formulation, Emulsifiers, Soil texture, Silage, Chemicals, Ditches, Persistence, Irrigation water, Harvesting, Mechanical control, Spraying, Water levels, Mammals, Birds, Snails, Insects, Fungi, Water quality, Soil sterilants, Eutrophication, Rivers, Biocontrol, Toxicity, Drawdown, 2-4-D, Aminotriazole.
Identifiers: Triazine, Dichlobenil.

Water weeds are posing increasing problems in many countries which depend on water control for development of agricultural, power, and transport resources. The United States, besides having its share of difficulties from water weeds, is also concerned with aquatic weed impairment of increasingly popular recreational aspects of water. Heavy water-weed infestation is expected when fertile land is submerged to form lakes, or when lakes and channels become silted. This problem is accentuated in developed countries by extra plant nutrients reaching water supplies from fertilizer and sewage effluent. Author presents a comprehensive review of the world's literature on aquatic weed control since 1960, to provide a guide to research with primary attention to those plants causing problems in warm environments. The literature citations are grouped as follows: Reviews, Identification, General recommendations, Important water weeds, Chemicals used in aquatic weed control, Control techniques, Biological control, Utilization of water weeds, Toxicology of herbicides to fish, Herbicides residues, and Water and its effect. Author indicates the need for more research in biological control and utilization of water weeds which might be useful in regions without the financial resources to deal with the problem. (Simsiman-Wisconsin)
W70-00269

SIGNIFICANCE OF THE NITRIFICATION REACTION IN NITROGEN BALANCES,
Tennesse Valley Authority, Muscle Shoals, Ala.; and Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02K.
W70-00282

PROBLEMS OF THE PROTECTION OF WATER IN CONNECTION WITH THE BUILDING OF WATER-POWER PLANTS (IN GERMAN),
P. Nanny.
Wasser- und Energiewirtschaft, No 8-10, p 270-274, 1959.

Descriptors: *Hydroelectric plants, *Water utilization, Water quality, Water pollution effects, Fish management, Groundwater, Vegetation effects, Climatic data, Weather modification, Electric power, Peak power, Low flow augmentation.

The building of hydraulic power stations could have negative influence on (1) water quality and self-purification of downstream section, (2) changes in fish community, (3) groundwater relations, and (4) climatic conditions and vegetation. These aspects can occur if the dam is built for increasing the water level or if the water is removed from a river basin. In the second case, the negative influence is much more important and must be treated properly taking into account the downstream load by waste waters. In this case a survey study on low flow values and waste waters purification is necessary. (Novotny-Vanderbilt)
W70-00292

INCREASE OF PROFIT BY WASTE-HEAT DISCHARGE LOSSES (IN DUTCH).
Algemene Kunstzijde Unie N.V. (Netherlands).
C. G. Booij.
De Ingenieur, No 51, p A749-A758, Dec 20, 1968. 18 fig, 2 ref.

Descriptors: *Economic efficiency, *Thermal pollution, *Coolants, *Power plants, Temperature control, Heat transfer, Cooling towers.
Identifiers: Process industry, Waste-heat production, The Netherlands.

The paper deals with three main aspects of the subject, reviewing waste-heat generation, and use of natural cooling waters, the influence of coolant and process temperatures respectively, on prime cost of product, and measures for reducing waste-heat production. In conjunction with these points, the various aspects of internal as well as external optimization are considered, illustrated by examples and diagrams. The waste-heat production of the Netherlands is estimated for 1966 at 45,000 M.W. A short description of the waste-heat sources is given. The increase during the last ten years of the waste-heat production in the process industry was about 23% per year and for power plants 20% per year. (Rietveld-Vanderbilt)
W70-00299

COMBINED CONDENSER COOLING SYSTEM UPS PLANT AVAILABILITY,
Tennessee Valley Authority, Knoxville.
Gordon L. Ford.
Power Engineering, Vol 71, No 1, p 40-42, Jan 1967. 3 fig.

Descriptors: Thermal pollution, Water temperature, *Cooling towers.
Identifiers: *Stream temperature, *Cooling towers, Counterflow and crossflow type towers, Paradise Steam Plant (T.V.A.).

The Paradise Steam Plant being built by T.V.A. has a cooling system which will increase the availability of the earlier two units and will end heat rejection to the river during the summer, thus meeting adequately the thermal stream pollution criterion. The operation of the earlier two units during low flow period was limited according to stream temperature. The yearly average temperatures are 57.3 F dry bulb and 52.2 F wet bulb. On this basis, the optimum condenser-tower combination was determined to be that which would provide 72 F average temperature water at a condenser flow of 715 cfs, and a cooling range of 27.5 F. Hyperbolic natural draft cooling towers were chosen because they will discharge moisture-laden air over four hundred feet above the ground, which eliminates ground fog or recirculation of air through the towers and because of the additional advantage of low maintenance and operating cost. (Upadhyaya-Vanderbilt)
W70-00300

STREAMS AND WATERS.

Ind Ann Stat sec 48-5610 (1963).

Descriptors: *Indiana, *Administrative agencies, *Rivers, *Streams, Maintenance costs, Maintenance, Bridges, Tunnels, Banks, Flow, Flow control, Obstruction to flow, Water pollution, Pollution abatement, Water pollution control, Bank protection, Banks.

The Board of Park Commissioners shall have the power to keep rivers, streams, and waterways that run through or bound park property open and free of pollutants. The Commissioners shall maintain the banks, build levees, control flow, and promulgate rules and regulations concerning said waterways. They shall construct any necessary dams, bridges, viaducts, or tunnels. They may require owners of real estate bounding on said waters to remove any pollutants from their banks or waters. The failure of property owners to comply empowers the Commissioners to remove such pollutants and to certify the cost of removal to the county treasurer who will assess the cost to the property involved. (Darragh-Florida)
W70-00381

OIL AND GAS WELLS--DECLARATION OF POLICY.
Iowa Code Ann sec 84.1 (Supp 1969).

Descriptors: *Iowa, *Surface waters, *Subsurface drainage, *Water pollution control, Legal aspects, Public benefits, Conservation, State governments, Legislation, Political aspects.

It is hereby declared that the general welfare requires that the underground and surface water of the state be protected from pollution and conserved in the best interests of the people of the state. (Heckerling-Florida)
W70-00386

OHIO RIVER VALLEY WATER SANITATION COMPACT.
Ky Rev Stat Ann sec 220.550 (1963).

Descriptors: *Kentucky, *Interstate commissions, *Water pollution control, *Interstate compacts, Legislation, Legal aspects, Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Ohio River, Water pollution, Pollution abatement, Water supply, Sewage treatment, Industrial wastes, Public health, Surveys, Watersheds (Basins), Water quality, Waste treatment, Water utilization, Standards.
Identifiers: *River valley commissions, River valleys, Interstate waters, Minimum standards.

The Ohio River Valley Water Sanitation Compact is enacted and entered into by the state. Kentucky is within the Ohio River drainage basin. Each of the party states pledges its cooperation in the control and abatement of pollution of waters common to two or more states. A sanitation district and a sanitation commission are created. Selection procedures for and the qualifications of commissioners are provided for as is the administration of the commission. The guiding principle of the compact is that pollution by sewage or industrial wastes originating with a party state shall not injuriously affect the various uses of the interstate waters. Minimum standards are set for the treatment of sewage and waste. The commission is empowered to promulgate rules and regulations for administering and enforcing the foregoing provisions. The commission will survey, study, and report on ways to reduce pollution and, in so doing, will confer with all interested agencies. The commission will draft and recommend to the governors of the signatory states uniform legislation dealing with pollution problems within the district. The commission will consult with and advise any party having particular problems connected with water pollution, particularly with regard to the construction of treatment plants. (Keith-Florida)
W70-00391

OIL, GAS, AND SALT WATER WELLS.

Ky Rev Stat Ann secs 353.150 to 353.190 (1963).

Descriptors: *Wells, *Kentucky, *Saline water intrusion, *Well regulations, Legislation, Damages, Legal aspects, Oil wells, Salts, Saline water, Regulation.

Any person in possession of any well in which oil, gas, or salt water is found shall, unless the product is used, close the well within a reasonable time. If the person in possession fails to comply, the nearest other possessor may enter and close it and recover costs from the possessor. The owner or occupant of any salt or saltpetre works shall keep the brine that is drained off enclosed so as to prevent access to it. When such works are abandoned it shall be filled up or enclosed by the owner or possessor. If these actions are not taken and injury to another's stock results, the persons under the duty to comply shall be jointly and severally liable for the damages. (Darragh-Florida)
W70-00394

DRAINS AND LEVEES-CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00395

NORTH SUBURBAN SANITARY SEWER DISTRICT V WATER POLLUTION CONTROL COMM'N (WATER POLLUTION CONTROL STANDARDS).
162 NW2d 249-259 (Minn 1968).

Descriptors: *Minnesota, *Water pollution control, *Sewage, *Standards, Administration, Pollution, Stream pollution, Water quality control, Water pollution treatment, Water pollution, Effluents, Cities, Impaired water quality, Pollution abatement, Sewage effluents, Potable water, Administrative decisions, Judicial decisions, Administrative agencies, Legal aspects.

The Water Pollution Control Commission was created to investigate pollution of the waters of this state, to establish reasonable pollution standards, to make reasonable orders requiring the discontinuance of the discharge of sewage or other wastes into any waters of the state, and to issue, deny, or revoke permits for the discharge of sewage. Respondent Sewer District was created to deal with sewage problems unique to its district. Pursuant to its powers and duties, the district planned for an outfall of effluent 1.1 miles downstream from the main water intake of the city of Minneapolis. The Commission has held that the possibility of contamination due to human failures and unusual natural conditions warrants a standard prohibiting such outfall. The district argues that the possibility of contamination is so remote that the standard is unreasonable and invalid. The trial court was justified in finding the standards unreasonable and exceeding the Commission's statutory powers. The prohibition was absolute and without reference to the purity of the effluent, and it was unreasonable to accept the probability that effluent would ever reach the water intake. These standards were only invalid as applied to these facts. (McFerrin Smith-Florida)
W70-00397

SANITATION DISTRICTS.
Ky Rev Stat Ann secs 220.010-220.540 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Administrative agencies, *Environmental sanitation, *Sewage districts, Sanitary engineering, Water pollution, Waste disposal, Eminent domain, Condemnation, Construction costs, Financing, Taxes, Project planning, Stream improvement, Sewers, Public health, Water pollution control, Legislation, Legal aspects.

The Commissioner of Sanitation Districts is vested with jurisdictional power and authority to establish sanitation districts within any county. Upon petition by freeholders or municipalities within a proposed sanitation district, the Commissioner may establish a sanitation district in order: (1) to prevent and correct pollution of streams; (2) to regulate the flow of streams for sanitary purposes; (3) to clean and improve stream channels; and (4) to provide for the collection and disposal of sewage and other liquid wastes. A board of directors governs the operation of each sanitation district. Each board has authority to (1) prepare plans for the construction or improvement of sanitation projects; (2) hold, encumber, and control by purchase or condemnation any real or personal property within the district; (3) contract and be contracted with; (4) levy certain annual taxes; (5) issue negotiable sanitation district bonds; and (6) do those things necessary to carry out the purposes of the district. (McDonough-Florida)
W70-00399

SANITATION DISTRICTS.
Ky Rev Stat Ann secs 220.010-220.130 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Water pollution control, *Administrative agencies, *Sewage districts, Stream improvement, Eminent domain, Condemnation, Environmental engineering, Environmental sanitation, Streams, Sewers, Laterals, Siphons, Waste disposal, Channel improvement, Legislation, Legal aspects, Liquid wastes, Cities, Local governments.

The state Director of the Division of Sanitary Engineering of the Department of Health also acts as the Commissioner of Sanitation Districts. He has the power to establish sanitation districts to prevent stream pollution, to clean streams, and to provide for the collection and disposal of sewage and liquid wastes. Sixty percent of freeholders within a proposed district or any municipality not of the first class may petition the Commissioner to establish a district. Municipalities within the proposed district may decide whether city property will be included within the district. Upon notice of the petition and a favorable investigation, the Commissioner may declare a sanitation district. Objection to the proposed district must be timely. The sanitation district is a political subdivision of the state with perpetual existence and powers: (1) to sue and be sued; (2) to contract and be contracted with; (3) to incur liabilities; (4) to exercise the right of eminent domain; (5) to assess and levy taxes; (6) to issue bonds; and (7) to do other acts to carry out the purposes of the district. The certificate establishing the district is binding on all district realty. (McDonough-Florida)
W70-00400

SANITATION DISTRICTS.
Ky Rev Stat secs 220.140-220.350 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Administrative agencies, *Sewage districts, *Project planning, Environmental sanitation, Contracts, Eminent domain, Condemnation, Sanitary engineering, Water pollution, Sewage, Stream improvement, Construction, Laterals, Siphons, Bids, Operation and maintenance, Water pollution control, Legislation, Legal aspects, Regulation, Control.

A sanitation district is governed by a board of directors which has all the powers of the district and controls all the affairs and property of the district. The board has the power to: (1) adopt necessary rules and regulations for the proper management and construction of sanitation projects; (2) hire an engineer and attorney; and (3) prepare and execute plans approved by the State Board of Health for the construction and improvement of sanitation projects. After a district is established, no person or corporation may install or construct any sewage facility without the approval of the board and the state Board of Health. The board is limited to operations aimed at the construction and maintenance of projects including: (1) the improvement of any stream, watercourse, or body of water receiving sewage; (2) the construction and maintenance of laterals, trunk sewers, intercepting sewers, and other disposal works; (3) the acquisition by purchase or condemnation of any real or personal property within the district; and (4) the contracting for sanitation service for wastes produced outside the district. Installation or operation contrary to this chapter constitutes an abatable nuisance. (McDonough-Florida)
W70-00401

SANITATION DISTRICTS.
Ky Rev Stat Ann secs 220.360-220.540 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Administrative agencies, *Financing, *Sewage districts, Costs, Construction costs, Taxes, Water pollution, Sewers, Sewage disposal, Project planning, Eminent domain, Environmental sanitation, Condemnation, Sanitary engineering, Legislation, Legal aspects, Cities, Maintenance costs, Rates.
Identifiers: Annexation.

The board of directors of a sanitation district may levy up to three annual taxes to cover initial costs. The board may issue negotiable warrants and sanitation district bonds to defray costs of construction and property acquisition. The bonds are not subject to taxation and are payable solely from sanitation district income but are not to be considered debts of the district within the meaning of the state constitution. Holders of district bonds have a statutory lien on all sanitation district property. The board determines reasonable rates and compensation or rentals to be charged for the use of sanitation facilities, but all rates must be uniform within a given class of users. A district may petition the commissioner of sanitation districts to annex additional territory to the existing district. Specified sized cities having their own sanitation systems may petition to annex part of or all of an existing sanitation district. (McDonough-Florida)
W70-00402

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

THIESSEN COEFFICIENTS BY A MONTE CARLO PROCEDURE,
Technion - Israel Inst. of Tech., Haifa. Hydraulic Lab.
For primary bibliographic entry see Field 07B.
W70-00039

ON THE DISTRIBUTION OF THE FREQUENCY OF RESERVOIR DEFICIT,
City Univ., London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W70-00041

A SYSTEM FOR PLANNING AND SCHEDULING WATER RESOURCE STUDIES AND CONSTRUCTION PROJECTS,
Geological Survey, Huron, S. Dak. Water Resources Div.
E. F. LeRoux, and D. G. Jorgensen.
Ground Water, Vol 7, No 5, p 16-18, Sept-Oct 1969. 3 p, 3 fig.

Descriptors: *Planning, *Project planning, *Critical path method, *Scheduling, Control, Timing, Water resources development.
Identifiers: Project Evaluation and Review Technique.

The techniques of network planning and scheduling are now firmly established as management tools in business and industry. By means of network diagrams showing time, phase, and cost relations, the techniques facilitate efficient scheduling and managing of projects of any size or complexity. The two most common methods of network planning and scheduling are PERT (Program Evaluation and Review Technique), which was developed by the U.S. Navy for use in the evaluation a review of development projects, and CPM (Critical Path Method), which was developed by International Business Machines and E. I. du Pont de Nemours and Co. The original versions of CPM and PERT differ in that CPM requires two time estimates, both related to cost, and PERT requires three time estimates related to probability. For planning and evaluation of water resources studies and construction projects, a simplification of the two systems requiring only one estimate (normal time) is ideally suited. (Knapp-USGS)
W70-00206

A NONLINEAR MODEL OF A WATER RESERVOIR SYSTEM WITH MULTIPLE USES AND ITS OPTIMIZATION BY COMBINED USE OF DYNAMIC PROGRAMMING AND PATTERN SEARCH TECHNIQUES,
Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
For primary bibliographic entry see Field 06B.
W70-00208

A TREATISE ON THE USE OF EXPECTED VALUES IN WATER RESOURCE PROJECT EVALUATION,
Southern Mississippi Univ., Hattiesburg. Dept. of Economics.
For primary bibliographic entry see Field 06B.
W70-00213

A SELECTED ANNOTATED BIBLIOGRAPHY ON THE ANALYSIS OF WATER RESOURCE SYSTEMS,
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 10.
W70-00306

OPERATIONS RESEARCH AND THE MEASUREMENT OF MATERIALS,
Carborundum Co., Niagara Falls, N.Y.
For primary bibliographic entry see Field 08G.
W70-00325

6B. Evaluation Process

STUDY OF WATER RESOURCES AND MANAGEMENT.

Ind Ann Stat secs 27-1701 thru 27-1709 (Supp 1968).

Descriptors: *Indiana, *Surveys, *Water rights, *Water resources, Water resources development, Water management (Applied), Water conservation, Ground water, Surface waters, Water utilization, Flood control, Pollution abatement, State jurisdiction, Legislation, Legal aspects, Planning, Projects, Federal government, Resource development, Interagency cooperation, Administrative agencies, Federal government.

A study committee is hereby appointed and directed to make a comprehensive survey and study of water rights and water management, including surface and ground waters in Indiana. The committee shall contain, among others, members representing the state flood control and water resources commission, the department of conservation, the board of health, and the pollution control board. The committee shall submit biennial reports to the legislature. State agencies are to cooperate with the committee in its efforts if requested. The state flood control and water resources commission, the board of health, and the water resources division of the department of conservation are authorized by the Water Resources Research Act of 1965 to conduct applied research in their respective areas for solution of problems involving the beneficial development, use, and management of the state's water resources. The need for additional knowlege is urgent in such areas as drainage of streams, meandering characteristics of alluvial streams, climatic effects of evaporation losses from impoundments, and mapping of the location and availability of ground water. The agencies are to report to the water resources study committee and are authorized to cooperate with other state agencies and the federal government. (Kelly-Florida)
W70-00128

OHIO RIVER AREA COORDINATING COMMISSION.
Ind Ann Stat secs 68-1301 thru 68-1304 (Supp 1968).

Descriptors: *Indiana, *Administrative agencies, *Ohio River, *Water pollution, Navigation, Flood control, Erosion control, Reforestation, Conservation, Water supply, Recreation, Pollution abatement, Interstate, Interstate rivers, Tourism, Coordination, Water pollution control Legislation, Legal aspects.

The Ohio River Area Coordinating Commission consists of representatives of named state commissions or departments, the legislature, and two universities. The Commission's purpose is to study problems and economic opportunities arising from the modernization of navigation facilities on the Ohio River. The study shall include floods, pollution control, erosion, conservation, and recreation. The Commission shall attempt to coordinate local, state, intrastate, and federal programs concerning the Ohio River area. A yearly report to the legislature is required. (McDonough-Florida)
W70-00196

GROUNDWATER STUDIES--CHICAGOLAND DEEP TUNNEL SYSTEM,
Harza Engineering Co., Chicago, Ill. Water Resources Planning Div.; and Metropolitan Sanitary District of Greater Chicago.
For primary bibliographic entry see Field 05G.
W70-00205

A SYSTEM FOR PLANNING AND SCHEDULING WATER RESOURCE STUDIES AND CONSTRUCTION PROJECTS,
Geological Survey, Huron, S. Dak. Water Resources Div.
For primary bibliographic entry see Field 06A.
W70-00206

A NONLINEAR MODEL OF A WATER RESERVOIR SYSTEM WITH MULTIPLE USES AND ITS OPTIMIZATION BY COMBINED USE OF DYNAMIC PROGRAMMING AND PATTERN SEARCH TECHNIQUES,
Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
L. E. Erickson, L. T. Fan, E. S. Lee, and D. L. Meyer.
Water Resources Bull, Vol 5, No 3, p 18-36, Sept 1969. 19 p, 12 fig, 1 tab, 15 ref. OWRR Project C-1032.

Descriptors: *Mathematical models, *Optimization, *Multiple-purpose reservoirs, *Reservoir operation, Recreation, Municipal water, Water supply, Hydroelectric power, Irrigation water, Flood control, Navigation, Sport fishing, Systems analysis, Dynamic programming.
Identifiers: *Pattern search.

A fairly realistic nonlinear model of a water reservoir system with multiple uses was developed based on available data, and the optimum of the system based on the developed model was determined by the combined use of dynamic programming and pattern search techniques. Both the simplex search and the Hooke and Jeeves pattern search were used. Modeling and optimization can treat complex inequality constraints. The benefits or losses resulting from urban water supply, hydroelectric power generation, irrigation, and recreation are taken into account in the profit function. Other uses such as flood control, navigation, and fish and wildlife enhancement are considered indirectly by the use of inequality constraints. It is concluded that the optimization-research approach can treat a water resource allocation problem involving complex inequality constraints. (Knapp-USGS)
W70-00208

A TREATISE ON THE USE OF EXPECTED VALUES IN WATER RESOURCE PROJECT EVALUATION,
Southern Mississippi Univ., Hattiesburg. Dept. of Economics.
D. C. Williams, Jr., and Donnie L. Daniel.
Water Resources Bull, Vol 5, No 3, p 50-56, Sept 1969. 7 p, 2 tab, 3 ref.

Descriptors: *Water resources development, *Project planning, *Evaluation, *Risks, *Economics, Flood control, Damages, Costs, Project life, Cost allocation, Cost-benefit analysis, Feasibility, Optimum development plans, Probability.
Identifiers: Project feasibility.

Factors that influence the acceptability of the expected-value criterion are examined in evaluating a method of handling risk or uncertainty in decision-making where damages from unusual physical occurrences such as hurricanes or floods must be considered. These factors are the project duration and the problem of obtaining accurate estimates of the probability of occurrence for different sizes of natural disasters. The problem of estimating accurate probabilities of occurrence for different sizes of natural disasters is not as great as it might appear and in most situations will not defeat the usefulness of the method. The time span during which the project is expected to exist has greater implications for the usefulness of the expected value criterion. For projects with a continual or long-term existence, the expected value approach appears highly applicable. However, it becomes less applicable for projects that are short-term in nature. The basis for distinguishing short- and long-term projects is presented. (Knapp-USGS)
W70-00213

ADMINISTRATIVE ASPECTS (OF WATER), (IN DUTCH),
Dijkgraaf van het Hoogheemraadschap van Delfland (Netherlands).
For primary bibliographic entry see Field 06D.
W70-00297

CONCEPTUAL PROBLEMS IN WATER-QUALITY ECONOMICS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Jour San Eng Div, ASCE, Vol 95, Oct 1969. p 3, Discussion of Proc Paper 6005 by W C Ray and W R Walker, June 1968.

Descriptors: *Benefits, *Water quality, *Optimum development plans, Public health, Recreation, Economic decision making, Value.
Identifiers: *Water quality benefits, Recreation benefits, Home environment, Working environment.

Without economic evaluation of water quality, there is no way to determine whether or not a given water quality standard represents an optimum situation. Ray and Walker consider benefits under headings of recreation, public health and aesthetic values. Methods of evaluating recreation benefits are now fairly well developed. Public health values are apt to remain intangibles, except for low standards that are not considered among debatable alternatives in the U.S. Aesthetic benefits is too narrow a concept for remaining benefits, which include improvements in both home environment and working environment. Although, as Ray and Walker point out, FWPCA officials in the past have moved slowly in this field, the Water Resources Council has expressed a government policy in favor of evaluating water quality benefits. (Whipple-Rutgers)
W70-00313

OHIO VALLEY COMPACT.

Ind Ann Stat secs 68-912 thru 68-917 (1961).

Descriptors: *Indiana, *Ohio River, *Interstate compacts, *Water resources development, Interstate commissions, Long-term planning, Natural resources, Human resources, Conservation, Resource development, Rivers, River systems, Legislation, Water utilization, Water resources, Planning.
The Ohio Valley Interstate Commission is hereby created to promote comprehensive planning for the optimal use of the Ohio River Valley's human and natural resources. The term 'Ohio Valley' means the Ohio River, its tributaries and all land drained by said river and tributaries, to the extent that they lie within the party states. Each party state may have seven commissioners. The commission shall have the power to: (a) promote the balanced development of the valley by certain procedures of recommendation and publication; (b) recommend integrated plans and programs for the conservation, development, and proper utilization of the water, land, and related natural resources of the Ohio Valley; (c) secure the necessary research and developmental activities; (d) make recommendations for appropriate action to the party states and the federal government. (Smith-Florida)
W70-00380

RECENT DEVELOPMENTS IN FISHING METHODS AND EFFECTS OF MANAGEMENT ON EFFICIENCY,
Dayton L. Alverson.
In Biological and Economic Aspects of Fisheries Management, College of Fisheries and the Department of Economics of the University of Washington at Seattle, p 142-147, Feb 17-19, 1959. 7 p.

Descriptors: *Management, *Fisheries, Salmon, Competition, Regulation, Trawling, Technology, Fish management, Fish attractants, Fish conservation, Productivity.
Identifiers: *Economic growth, Shrimp, Cod trawlers.

Fishing is one aspect of water resources which has experienced a large growth in technology since the end of World War II. The author gives the causes of this growth and some of the improvements resulting from it. The effect of these improvements is studied with special emphasis on the deficiencies of the United States in this area. Regulations in the area have not been what might have been hoped for and have been detrimental to the fishing industry in many situations. Management of ocean fisheries has been wrong in attempting to control production by controlling efficiency. The international position of world fisheries is in a very competitive status and inefficiency cannot be tolerated. (Murphy-Rutgers)
W70-00413

ALTERNATIVE USES OF THE NATURAL ENVIRONMENT,
Economic Development Administration, Washington, D.C.; and Vermont Univ., Burlington.
Harvey A. Garn, and Gene Laber.
In Planning 1968, Selected Papers from the ASPO National Planning Conference, San Francisco, p 262-270, May 4-9, 1968. 9 p, 10 ref.

Descriptors: *Conservation, *Environment, Economic impact, Industrial production, Income, Water pollution, Fishing, Costs, Deterioration, Social values, Income analysis.
Identifiers: *Social accounting system, Market system, Income distribution, Social benefits, Social costs.

The article argues from the premise that in order to achieve over-all increases in per capita income, some natural resources, including, of course, water resources, must be expended. It stresses the need in general for a full social accounting system for intelligent decision-making with explicit recognition of possible distribution objectives. It also deals specifically with the special circumstances which surround the question of resource use in low-income regions. The social accounting system is needed especially to deal with the classic externality problems encountered as well as some complex income distribution implications. In addition, many of the outputs lack market values. Some interesting suggestions are also made for the use of natural resources in low-income regions as an integral part of the larger topic of resource allocation stressed here. Water resources planning is concerned with most of the same problems. (Murphy-Rutgers)

W70-00414

FLOOD CONTROL BENEFITS AND THE TENNESSEE VALLEY AUTHORITY,
Georgia State Coll., Atlanta, Ga. School of Business Administration.
James E. Hibdon.
Southern Economic Journal Vol XXV, No 1, p 48-63, July 1958. 16 p.

Descriptors: *Flood control, Economic evaluation, Taxes, Government, Economic analysis, Benefits, Economic justification, Costs, Dam, Statistics, Flood damage, Flood plain, Welfare economics, Pricing, Indirect benefits.
Identifiers: *TVA, *Flood losses, *Land value.

The author raises questions concerning the accuracy of the flood control benefits provided by the TVA. Flaws are demonstrated to exist in the assumptions on which the estimates were based and indicate that the estimates are exaggerated. The flood control program may be justified economically but proof of the justification would require a better determination of the value created as well as a test of its adequacy relative to the costs. The author also questions the subsidy which accrues to bondholders who gain the benefits of increased productivity but do not pay the costs of flood control. The application of a levy against land as a feasible means of exacting payment from beneficiaries of flood control programs is proposed. (Murphy-Rutgers)
W70-00416

6D. Water Demand

WATER-USE AND WATER-RIGHTS POLICY IS CHANGING,
J. A. Johnson.
J Soil Water Cons, Vol 14, No 1, p 3-6, Jan 1959. 4 p.

Descriptors: *Water policy, *Water rights, *Water users, *Southeast U. S., Legislation, Reasonable use, Public benefits, State governments, Judicial decisions, Legal aspects, Water law, Political aspects, Riparian rights, Planning, Storage, Beneficial use, Water demand, Water resources, Water allocation (Policy), Water demand.

Eastern states are taking a new look at water problems and water-rights policies. State legislatures and water-user organizations are attempting to educate the public to these problems. Studies have been instituted in an attempt to evolve water policies which will meet modern needs. Water policy may be defined by the legislature in one broad act and usually goes as far as the people are ready to act. Water policy, to be fully effective, must be acceptable to the people or users to which it applies. In years past water-rights policies and laws were for the most part court-made. Water users wanting more adequate protection for their investments and more specific rights of use pushed for a change in water policy. Formal action began in the early 1950's in the Southeast. The direction of change has been toward beneficial use, conservation of supplies, encouragement of seasonal storage, and restrictions upon waste and unreasonable methods of use. Southeastern states have adopted in their new laws one or more aspects of the western system. An example is the general declaration of reasonable beneficial use found in a number of eastern statutes. The water-use needs and water problems of this entire section of the country have changed materially in recent years. Such adjustments as prove necessary can be made with benefit of a vast background of experience existing in all states. (Heckerling-Florida)
W70-00085

WATER RIGHTS AND OUR EXPANDING ECONOMY,
C. E. Busby.
J Soil and Water Cons, Vol 9, No 1, p 65-69, Jan 1954. 5 p.

Descriptors: *Water rights, *Water utilization, *Water law, *Water resources development, Reasonable use, Prior appropriation, Riparian rights, Administration, Water demand, Water management (Applied), Water conservation, Water allocation (Policy), Water consumption, Judicial decisions, Damages, Legal aspects, Groundwater, Water supply, Water conservation.

Recently some states have experienced a considerable expansion in water use by agriculture, industry, towns, and cities. As a result, competition and conflicts have arisen, especially during periods of great water demand and limited water supply. These conflicts of interest over water are not new. The system of water rights and administration in the eastern states is very different from that in western states where life is directly or indirectly dependent on water. These systems differ in three basic areas: (1) the emphasis placed upon beneficial use and conservation of water, (2) the emphasis placed upon security for and encouragement of investments in water development and use, and (3) the emphasis placed on statewide and local administrative responsibility for guiding water development and use. All three policies are emphasized in the West, but not in the East. Some of the most vital questions of policy which need examination are: (1) the use and damage aspects of water, (2) water law and administration in general, (3) rights to water in the air, and (4) rights to water on the ground. The present water law found in the East was developed by the courts over one hundred years ago and is in need of modification along lines consistent with present water and related land capabilities. (Heckerling-Florida)
W70-00088

A STATE STATUTE TO POVIDE CONTROLS FOR EQUITABLE DISTRIBUTION OF WATER.
Harv J Legis, Vol 4, No 3, p 399-419, Jun 1967. 21 p, 70 ref.

Descriptors: *Legislation, *Administrative agencies, *Water resources development, *Future planning, Administration, Decision making, Riparian rights, Prior appropriation, Optimum development plans, Resource allocation, State governments, Water allocation policy, Water users, Permits, Water policy, Water resources, Water supply.
Identifiers: *Equitable water distribution.

This article proposes a statute to deal with the imminent water shortage facing the eastern half of the United States. Citing the inefficiency of both the riparian and prior appropriation theories, the article proposes an administrative system. A discussion of the background and perspective of the proposed statute, including constitutional problems, precedes the body of the statute. The statute contains eight articles. Article one contains definitions of terms. Article two sets forth a declaration of policy and standards which calls for the development, utilization, and control of all water resources to effectuate the maximum public benefit. Articles three and four establish a Water Resources Board with jurisdiction over all water resources in the state. A broad variety of powers and duties, consistent with the purposes of this legislation, are detailed. Article five requires permits for the use of water. A detailed system to insure that all water is distributed equitably and beneficially is provided, and procedures for applications, hearings, fees, and judicial review are outlined. (Schram-Florida)
W70-00184

WATER LEGISLATION,
Edward Hamming.
Economic Geography, Vol 34, No 1, p 42-46, Jan 1958. 5 p, 11 ref.

Descriptors: *Legislation, *Water law, *Water utilization, *Riparian rights, Reasonable use, Prior appropriation, Surface waters, Percolating water, Land tenure, United States, Water rights, Groundwater, Legal aspects, Water demand State governments, Water resources, Overlying proprietor, Public rights, Flow, Water supply.

With the demand for water in the United States constantly increasing there is a need for state regulations defining and delimiting the rights of individuals and corporations in utilizing this resource. There are two basic doctrines of water use: the riparian or common law rule and the prior appropriation doctrine. The fundamental differences between the two doctrines have caused a long history of litigation and have brought about drastic modifications in water rights legislation. The riparian doctrine applies to both surface and underground waters. In the former case it is aimed at maintaining an unrestricted flow of water in surface streams; in the latter case the owner of the overlying land has the absolute ownership of percolating water existing in his land. Recent trends put groundwater on the reasonable use basis or apply the same principles of use and administration to groundwater as are applicable to surface waters. The trend is toward appropriation, which calls for effective public control. Any change in water legislation must be based on scientific research, for efficient utilization of the water supply may be had under either the riparian or appropriation doctrines, provided the governing principles are well defined and applied. (Heckerling-Florida)
W70-00185

ADMINISTRATIVE ASPECTS (OF WATER), (IN DUTCH),
Dijkgraaf van het Hoogheemraadschap van Delfland (Netherlands).
J. P. Winsemius.
De Ingenieur, p A 762-764, Dec 20, 1968.

Descriptors: *Water resources development, *Administration, Water allocation, Local government.

The problem of the scarcity of water is, on a national scale, not an unfavorable overall balance position, but a liquidity problem. Usually the quantity of water should be sufficient if carefully controlled and distributed on a national and regional level. Firstly, this management will have to be one of the bases of the overall national planning and the annexed regional planning especially in relation to (1) industrial activity and (2) the location of power plants. Secondly, management of surface- and groundwater should be closely co-ordinated and in most cases even integrated. Thirdly, this co-ordinated management should balance all interests concerned and should have means at its disposal in order to compensate interested parts. Finally, a strongly co-ordinated management will have to curtail the historically grown autonomy of boards on lower level, either by reorganizing their tasks in the framework of the new national structure, or by winding up these boards and transferring their tasks. (Sherman-Vanderbilt)
W70-00297

RESEARCH ON RECREATIONAL USE OF WATERSHEDS AND RESERVOIRS,
Bureau of Water Hygiene, Cincinnati, Ohio.
J. Keith Carswell, James M. Symons, and Gordon G. Robeck.
J Amer Water Works Ass, Vol 61, No 6, p 297-304, June 1969. 8 p, 5 fig, 2 tab, 13 ref.

Descriptors: *Domestic water, *Water pollution, *Water supply, Water pollution control, *Municipal water, *Recreation, Swimming, Boating, Fishing, Potable water, Aesthetics, Public health, Bacteria, Coliforms, Streptococcus, Water quality, Water treatment.
Identifiers: Public Health Service, Bacteria control, Virology.

Public pressure for water-based outdoor recreation is growing in the United States. Because of heightened interest, increasing attention is being given to the possibility of using public water supply sources for recreation. Five studies were made in various locations to determine the impact of water-based recreation on water quality. These studies indicated that little or no deterioration in bacterial water quality occurs at the water supply intake when recreation is permitted in or around public

water supplies. In cases where some rise in indicator organism density occurred, it was localized within the high recreational use areas and the bacterial content at the water supply intake was within the limits that permit removal by existing water treatment technology. Problems of aesthetics and loss of control of utility property, and concern over a slight deteriorating trend in water quality will probably make the decision a local matter, causing utilities to proceed cautiously in opening their reservoirs for recreation. (USBR)
W70-00348

6E. Water Law and Institutions

DRAINS AND LEVEES AFFECTING HIGHWAYS.
For primary bibliographic entry see Field 04C.
W70-00011

MCCUE V CARLTON (TITLE TO ACCRETIONS).

399 Ill 11, 76 NE2d 435-438 (1947).

Descriptors: *Illinois, *Accretion (Legal aspects), *Boundaries (Property), *Riparian land, Judicial decisions, Bank erosion, Erosion, Avulsion, Boundary disputes, Sedimentation, Stream erosion, High water mark, Riparian rights, Rivers, River beds, Water law, Streams, Legal aspects, Land forming.
Identifiers: Adverse possession.

Plaintiff owned land on a river, the deed to which granted title to the shoreline of the river. Defendant owned land adjacent to plaintiff. Defendant's deed excluded title to any land lying below the highest high water mark. Both parties claimed title to land formed by accretion and by recession of the river on one side. They both claimed by adverse possession. Plaintiff brought an action to confirm title and to enjoin trespassing by the defendant. The court held title to be in plaintiff. Accretions to riparian land held under a claim of adverse possession or by color of title go with the land to which they are attached. To acquire land formed by accretion there must be a natural and actual continuity to the land of the riparian owner. Defendant's land, because of the exception in his deed, was not riparian, and he could have no title in accretions. The court found that the evidence confirmed that title to the accretion was in plaintiff by adverse possession. (Helwig-Florida)
W70-00061

EMINENT DOMAIN AND WATER LAW,
Richard S. Harnsberger.
Neb L Rev, Vol 48, No 2, p 325-455, Jan 1969. 131 p.

Descriptors: *Eminent domain, *Water law, *Condemnation, *Compensation, Legislation, Legal aspects, Public benefits, Highways, Water policy, Water resources development, Damages, United States, Riparian rights, Navigable waters, Cities, Water supply, Regulation, Judicial decisions, Water allocation (Policy), Watercourses (Legal), Condemnation value, Dams, Streamflow, Multiple-purpose projects.

The doctrine of eminent domain has played a unique role in the attainment of social and economic goals in the United States because it permits property to be taken rather easily from private persons for public uses and purposes. Today condemnation procedures are particularly significant tools in urban renewal projects, municipal and state expressways, national interstate and defense highways, multipurpose water development undertakings, sewerage, and flood control works. One of the most troublesome legal questions growing out of the eminent domain doctrine is whether the government should be required to pay compensation for particular property taken or damaged by this action. This article examines that question generally and in the context of selected situations in water development and allocation. (See W70-00071 thru W70-00082). (Heckerling-Florida)
W70-00070

THE NATURE AND SCOPE OF THE EMINENT DOMAIN POWER,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 327-342, Jan 1969. 16 p.

Descriptors: *Eminent domain, *Public rights, *Damages, *Compensation, Federal government, Adjudication procedure, Judicial decisions, State governments, Construction, Condemnation, Legal aspects, Land tenure.
Identifiers: Reserved rights, Sovereignty.

The power of both state and federal governments to acquire private property for a public or a semipublic use is well recognized and is theoretically explained as either a 'reserved right' or a power inherent in 'sovereignty'. Under the 'reserved right' theory, the state is the presumed original owner of all property and subsequent private ownership is deemed subject to the prerogative of the sovereign to resume possession whenever the best interests of society require. By definition the sovereign power of eminent domain applies only to a taking for a public use and does not exist if the proposed use is private. Any private use is therefore without either sovereign or constitutional authority. The concept of public use is given a broad definition in eminent domain proceedings. As distinguished from public purpose, the extent of public necessity for the construction and location of an improvement is a legislative question and not subject to judicial review. In addition to prohibiting the taking of property for private purposes, the due process clause of the Constitution requires that eminent domain, as an exclusively legislative prerogative, be authorized by action of the legislature. The due process clause imposes safeguards in favor of the property owner including just compensation and trial by jury. (See also W70-00070). (Heckerling-Florida)
W70-00071

EMINENT DOMAIN AND POLICE POWER,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 342-354, Jan 1969. 13 p.

Descriptors: *Eminent domain, *Compensation, *Public benefits, *Land tenure, Legal aspects, Judicial decisions, Condemnation value, Damages, Standards, Regulation.
Identifiers: *Police powers.

The general concepts governing eminent domain and the police powers cut across many types of decisions and become significant when determining whether compensation is payable. When private property is taken for public use under the power of eminent domain, the owner is entitled to receive just compensation. Conversely, if a restriction upon the utilization of property is merely a proper exercise of the government's police power, no compensation is due. Compensation is payable whenever an owner is physically dispossessed, but only consequential damages occur where there is no dispossession. This test fails to demonstrate the method of reasoning and merely places the problem in terms which are no more helpful and only one step removed from the primary terms, police power, and eminent domain. It has come to be recognized that there is only a difference in degree between non-compensable damage to a property owner under the police power and a deprivation of property rights under the power of eminent domain. Some authorities take the position that no compensation is payable where a regulation forces an owner to bear the external costs or burdens of his private activities, but that compensation should be paid when benefits accrue to the community. (See also W70-00070). (Heckerling-Florida)
W70-00072

PRIVATE UNDERTAKINGS AS PUBLIC USES,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 354-366, Jan 1969. 13 p.

Descriptors: *Eminent domain, *Public benefits, *Water utilization, *Judicial decisions, Legislation, Riparian rights, Local governments, Jurisdiction, Condemnation.
Identifiers: Constitutions.

Theoretically, property taken by eminent domain should be put strictly to public use. Even though a legislature approves a project as a public one, the ultimate decision as to whether the use is in fact public, rests with the courts. There is no exact definition of the term 'public use', and most courts make no effort to formulate one. Water is so important in arid states that many constitutions have provisions for its utilization. Constitutional provisions take several different forms. In the western states, the existence of water preference provisions may also affect the right of eminent domain. Generally, preference provisions manifest a policy to favor certain uses of water and are enacted as either constitutional or statutory provisions. Several western states allow a private person to exercise eminent domain to acquire property for his own exclusive use. Since public needs obviously must be determined in relation to environment, local conditions are an important factor in any jurisdiction which considers public benefit or advantage in determining whether private utilization of condemned property is for a 'public use'. (See also W70-00070). (Heckerling-Florida)
W70-00073

MUNICIPAL WATER SUPPLIES,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 366-377, Jan 1969. 12 p.

Descriptors: *Eminent domain, *Cities, *Municipal water, *Riparian rights, Judicial decisions, Compensation, Condemnation value, Riparian land, Public benefits, Damages, Natural flow doctrine, Reasonable use, Jurisdiction, Land tenure, Value, Water supply, Diversion.

Towns and cities are everywhere empowered by either statute or state constitution to condemn private water rights to secure water for public or domestic uses, and this effectively gives them a preference to use water on condition that the owners are compensated. The amount a municipality must pay when condemning water rights depends upon local water law. The 'natural flow' riparian doctrine is extremely wasteful in that it gives every riparian owner the right to have stream waters flow uselessly into the sea. It has been replaced in many jurisdictions by a 'reasonable use' riparian doctrine. The reasonable use doctrine allows riparian owners to divert such water as they may reasonably use to satisfy the natural demands for water upon their riparian property. The usual measure of damages under the riparian doctrine for the taking of water is the depreciation in value of the riparian land. When a municipality condemns property to obtain a new source of water supply, a problem arises as to how the landowner should be compensated. Should he be compensated according to the market value of his land or according to the value to the municipality. The courts are divided on this question. (See also W70-00070). (Heckerling-Florida)
W70-00074

CONDEMNATION FOR PUBLIC PROGRAMS,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 377-388, Jan 1969. 12 p.

Descriptors: *Eminent domain, *Condemnation, *Public benefits, *Federal government, Judicial decisions, Watercourses (Legal), Riparian rights, State governments, Streamflow, Beds, Beds under water, Navigable waters, Navigation, Docks, Bridges, Compensation, Flood control.
Identifiers: Navigational servitude.

Controlling floods, canalizing channels, developing watersheds and river basins, and stabilizing watercourses for downstream purposes are programs primarily undertaken by the federal government. States have not entered into these areas to any significant degree. One of the most important delegated powers of the federal government relating to water is the commerce clause. A watercourse is subject to the power of Congress if navigable in its natural condition. Riparian owners have a number of special rights which are recognized by state laws as being inseparably connected to the land. Just compensation is due when they are taken for public uses. Activities by riparian proprietors and the United States frequently interfere with uses the other wants to make of the stream flow or the beds. Under a number of court decisions, a riparian owner's rights are qualified by the federal navigation servitude whenever his property is located in the bed of a stream below high water level. He is entitled to no compensation for distruction of: a submerged bed, access to water, wharves and other structures, bridges over the watercourse, or rights in the flow of the water. (See also W70-00070). (Heckerling-Florida)
W70-00075

THE 'RIVER' CASES,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 388-410, Jan 1969. 23 p.

Descriptors: *Eminent domain, *Judicial decisions, *Federal government, *Condemnation, Compensation, Alteration of flow, Diversion, Water level fluctuations, Water rights, Land tenure, Water law, Flood control.
Identifiers: *Inverse condemnation.

The liability of the government for artificially changing the level of the water and for backing up or changing the direction of flow has been considered in numerous cases in the period from 1871 to 1950. These cases arose chiefly from governmental flood control activities. Physical seizure of water rights by the United States may be accomplished by either a physical invasion of land or an upstream interference with the water flow. The ability of the United States to appropriate property by physical seizure, rather than by direct condemnation, has produced many major decisions in eminent domain law. Injunctive relief is rarely granted. The 'river' cases are important precedents for determining what kinds of property rights may be successfully asserted in seeking compensation for condemnation against the United States. Supreme Court decisions are persuasive authority in state courts. (See also W70-00070). (Heckerling-Florida)
W70-00076

PROBLEMS OF VALUATION AND THE MILLER RULE,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 410-415, Jan 1969. 6 p.

Descriptors: *Eminent domain, *Condemnation value, *United States, *Compensation, Judicial decisions, Land use, Condemnation, Reclamation, Projects, Value.

Many complex problems arise in attempting to define and measure just compensation, and opinions differ over the proper methods to be used in establishing the value of the property taken. The almost universally accepted formula is fair market value of the property at the time of the taking. Potential utilization of the property by the owner is a relevant factor, but special value to the condemnor may not be made a part of the award. Large public works such as reclamation projects often involve hundreds of thousands of acres of land. To protect the government from paying for the increased value resulting from its own activities, the so-called Miller rule specified that if property is 'probably within' the scope of the project from the time the government is committed to the undertaking, even though ultimately it might not be taken, any increase in value due to the project is excluded. (See also W70-00070). (Heckerling-Florida)
W70-00077

THE 'POSSIBILITY OF COMBINATION' RULE; EFFECT OF FEDERAL WATER POWER ACT ON PRIVATE RIGHTS,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 415-422, Jan 1969. 8 p, 19 ref.

Descriptors: *Eminent domain, *Federal Power Act, *Riparian rights, *Compensation, Judicial decisions, Federal government, State governments, Condemnation value, Land use, Navigable waters, Legal aspects.

The majority of the decisions reveal that private owners have been confronted with a number of legal hurdles in their efforts to obtain compensation from the government. Generally, the rule is that if the property under consideration must be consolidated with other properties to make it suitable for a special use, such special use cannot be considered in the valuation unless the possibility of affecting the necessary combination is so likely that market value is affected. Under the Federal Water Power Act rights under state law to use the water of a navigable stream are not abolished. When the United States delegates its power by granting a license under the Federal Water Power Act, the license must pay for damage to private riparian rights even though the riparians would have been unable to recover from the federal government for the same harm. (Heckerling-Florida)
W70-00078

NON-COMPENSABILITY OF LOCATIONAL VALUES ATTRIBUTABLE TO USE OF THE FLOW,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 422-434, Jan 1969. 13 p, 36 ref.

Descriptors: *Eminent domain, *Condemnation value, *Compensation, *Navigable waters, Judicial decisions, Federal government, Streamflow, Regulation, Riparian rights, Legislation, Navigation, Flood control, Watercourses (Legal), Legal aspects, Water law.

When the United States exercises its navigation easement, riparian lands on a navigable watercourse can gain no value from possible uses of the water which an owner might have made. An owner is not entitled to compensation for location values attributable to uses, actual or potential, which are dependent upon use of the water or access to it. Federal statutes provide that when land is taken for a river improvement, compensation is to be reduced by any special and direct benefits conferred by the project upon the owner's remaining land. No rights attach to the flow of a non-navigable tributary when Congress exercises its power to control floods in aid of navigation on a navigable main stream. Riparians on both navigable and non-navigable streams hold their property subservient to the power of Congress to regulate and improve navigable waters of the United States. The power is applied when Congress specifies the waters which it believes are necessary in aid of navigation. The Supreme Court has denied compensation for the value of riparian lands attributable to the flow of a navigable watercourse. (Heckerling-Florida)
W70-00079

SUMMARY OF SERVITUDE DECISIONS RELATING TO COMPENSABILITY,
Richard S. Harnsberger.
IN Eminent domain and water law. Neb L Rev, Vol 48, No 2, p 434-435, Jan 1969. 2 p, 11 ref.

Descriptors: *Eminent domain, *Judicial decisions, *Federal government, *Compensation, Condemnation value, Navigable waters, Non-navigable waters, Navigation, Water levels, Riparian land, Tributaries, Watercourses (Legal).
Identifiers: *Servitudes.

In reviewing the servitude cases several important factors stand out. First, the servitude is not co-extensive with the power of the United States over the country's watercourses under the commerce clause. The navigation power today extends to watercourses navigable in fact, those which are non-navigable but can be made navigable by artificial improvements at a reasonable cost, and non-navigable tributaries. Second, recovery against the Government is more likely if the level of the water in the watercourse is raised. Third, there have been few recoveries against the Government between 1871, when compensation was awarded for flooding riparian uplands and 1950, when recovery was permitted for the backing up of a non-navigable tributary onto riparian property. Fourth, the principal compensable situation arises when work done by the United States for improvement of navigation causes water to permanently overflow lands above ordinary high water mark. Fifth, the Government incurs no liability for activities in aid of navigation when these are carried on between the ordinary high water marks of navigable stream beds; but when the Government exercises its power over navigable streams and thereby causes interference or injuries to private property on non-navigable tributaries, compensation is payable. (Heckerling-Florida)
W70-00080

THE SERVITUDE DOCTRINE; THE DOCTRINE UNDER ENGLISH LAW,
Richard S. Harnsberger.
IN Eminent Domain and Water Law, Neb L Rev, Vol 48, No 2, p 436-442, Jan 1969. 7 p, 25 ref.

Descriptors: *Eminent domain, *Navigable waters, *Federal government, *Public rights, Judicial decisions, Compensation, Water law, Legal aspects, Riparian land, Non-navigable waters, Federal jurisdiction, Fishing, Tidal waters.
Identifiers: Servitude doctrine, Commerce, Common law.

Awarding compensation to riparians on non-navigable streams for damages when water in the main channel is lawfully raised to improve navigation relieves them from bearing part of the cost of the federal project. A review of decisions leads to the conclusion that the Supreme Court is not confident about how the servitude doctrine became the 'raison d'etre' of plenary federal power over the nation's watercourses. It has been stated the the source of the power arises from: (1) the commerce clause of the Constitution; (2) the fact that persons acquiring property on navigable streams have had 'ample notice over the years that such property is subject to a dominant public interest'; and (3) the common law of England. A comparison between the servitude doctrine and the English law gives persuasive weight to the conviction that the doctrine has its roots in antiquity. Under English law the King controlled navigable watercourses and treated then as his own. English waters later became classified either as public or as private. Fishing and navigation rights existed in connection with English waters and the submerged beds. Crown rights in tidal waters could be conveyed only with the permission of Parliament. (Heckerling-Florida)
W70-00081

THE COMMON LAW RIGHT OF THE PUBLIC TO NAVIGATE IN PRIVATE WATERS; STATUS OF STATE CREATED RIGHTS,
Richard S. Harnsberger.
IN Eminent Domain and Water Law. Neb L Rev, Vol 48, No 2, p 442-455, Jan 1969. 14 p.

Descriptors: *Eminent domain, *Public rights, *State jurisdiction, *Navigable waters, Navigation, Federal government, Judicial decisions, Water-

courses (Legal), Compensation, Irrigation, Consumptive use, Water law, Legal aspects, Tidal waters.
Identifiers: *Navigational servitude.

A public right to navigate was recognized in the American Colonies. After adoption of the Constitution, the federal government became the preserver of the privilege of free passage. The United States Supreme Court made certain basic modifications of the common law to accommodate the conditions and topography of the country, but the concept continued that waters navigable in fact were public as to use. At the state level, power may be exercised either under the doctrine that the ownership of water is held in trust for the people or under the doctrine of navigational servitude. A subcommittee of the American Bar Association reported that the servitude doctrine has inhibited the development of waterfront areas over navigable waters by private enterprise. Another important problem relates to the effect of the servitude upon diversions for irrigation, municipal supplies, and other consumptive uses. Congress may exercise less than its entire power and in the past has frequently recognized state law. In recent years, numerous efforts have been made to subject the federal government to state water law. In view of the plenary power of the United States, the matter of compensability is almost entirely a matter of Congressional policy. (See also W70-00070). (Heckerling-Florida)
W70-00082

RIPARIAN RIGHTS - REASONABLE USE THEORY.
For primary bibliographic entry see Field 04A.
W70-00083

NAVIGATIONAL SERVITUDE: AN OLD CONCEPT WITH A NEW LIMITATION,
For primary bibliographic entry see Field 04A.
W70-00084

WATER-USE AND WATER-RIGHTS POLICY IS CHANGING,
For primary bibliographic entry see Field 06D.
W70-00085

POLLUTION CONTROL AMENDMENTS URGED.
For primary bibliographic entry see Field 05G.
W70-00086

OUTLINE OF ARKANSAS PLAN ON WATERSHED MANAGEMENT.
For primary bibliographic entry see Field 04D.
W70-00087

WATER RIGHTS AND OUR EXPANDING ECONOMY,
For primary bibliographic entry see Field 06D.
W70-00088

ACCESS BY THE PUBLIC TO A PRIVATE BODY OF WATER FOR RECREATIONAL PURPOSES.
For primary bibliographic entry see Field 04A.
W70-00089

A NEW METHOD OF IRRIGATION,
For primary bibliographic entry see Field 03F.
W70-00090

WATERS--RIPARIAN RIGHTS--PROPERTY IN FLOW OF STREAM.
For primary bibliographic entry see Field 04C.
W70-00091

EMINENT DOMAIN - WATERS AND WATERCOURSE'S INTERFERENCE WITH DRAINAGE FROM LAND ON NON-NAVIGABLE TRIBUTARY CAUSED BY GOVERNMENT DAM ON NAVIGABLE RIVER HELD COMPENSABLE UNDER FIFTH AMENDMENT.
For primary bibliographic entry see Field 04A.
W70-00092

POLLUTION OF STREAMS--SEWAGE DISPOSAL PLANTS.
For primary bibliographic entry see Field 05G.
W70-00093

HIGHWAYS, BRIDGES, AND FERRIES-PROVISIONS FOR PARTICULAR COUNTIES.

SC Code Ann secs 33-1467, 33-1469, 33-1485, 33-1705, 33-1711, 33-1741, 33-1758, 33-1783 (1962).

Descriptors: *South Carolina, *Highways, *Bridges, *Local governments, Road construction, Right-of-way, Legislation, Manpower, Engineering personnel, Labor, Personnel, Rivers, Culverts, Regulations, Bridge construction, Bridge design, Transportation, State governments, Civil engineering, Costs, Financing, Legal aspects.

The governing body of Charleston County may sell any rights-of-way, roads, or bridges standing in the name of the county. Such governing body may pass regulations to prevent improper drainage pipes from being placed along county roads and shall insure adequate drainage along all county roads. The bridge fund of Cherokee County shall be expended in maintenance of bridges and culverts in various townships. The governing body of Hampton County shall not let by contract the construction or repair of any bridge which can be done by a chain-gang force. Anyone operating a vehicle who damages a bridge in Horry County shall report the fact immediately or be subject to a fine. The governing body of Lancaster County shall have authority over all highways and bridges and may construct new ones as needed. The county shall, by the chain-gang or other means, keep all highways and bridges in proper repair. One mill of the 5 mill levy on property shall be for the construction of permanent bridges which shall be constructed of reinforced concrete or steel. No one shall close a road, bridge, or ferry in Lexington County without the permission of the governing body. (Helwig-Florida)
W70-00094

LOMBARD PARK DIST V CHICAGO TITLE AND TRUST CO (AUTHORITY TO MAP FLOOD PLAIN ZONING).
IN Eminent Domain and Water Law. 245 NE2d 298-303 (Ill App Ct 1969).

Descriptors: *Illinois, *Flood plain zoning, *Geologic mapping, *Condemnation value, Judicial decisions, Zoning, Regulation, Flood plains, Geomorphology, Building codes, Legal aspects, Mapping, Contours, Maps, Data collections, Surveys, Condemnation, Eminent domain, Compensation.

In a condemnation proceeding, a map was introduced to show that the property in question was in a flood plain area where residences could not be built. The map was admitted as an official public document and an exception to the hearsay rule. Generally, public records come within the exception if required either by statute or authorized to be maintained by the nature of the office, and if they concern matters to which the official charged with preparation could testify if called as a witness. The map in question was a study of a wide array of hydrologic data to evaluate the depth and frequency of flooding and was prepared by the U. S. Geological Survey. The court held that admission of the map was prejudicial to the judgment and reversible error. There was no showing of statutory authority to determine flood plains nor was it incidental to examining geological structure and mineral resources. The legend on the map did not include the property in question within the plain of overflow, nor was the data proven to be sufficiently reliable or such that the preparing official could have testified as to its nature. (Douberley-Florida)
W70-00095

UNITED STATES V MORAN TOWING AND TRANSP CO (LIABILITY FOR OBSTRUCTION OF NAVIGABLE WATERS).
409 F2d 961-963 (4th Cir 1969).

Descriptors: *Navigable waters, *Damages, *Federal government, *Remedies, Judicial decisions, Legal aspects, Maryland, Legislation, Navigation, Harbors, Docks, Costs, United States.
Identifiers: *Drydocks, Obstruction of navigation.

In calm seas and clear weather defendant's floating drydock took on water and foundered while under tow. The wreck obstructed navigation, and the United States took action to recover cost of removal from the owner and towing company. The district court found for the United States on grounds that the drydock was not a 'vessel' or 'craft' under the scope of 33 USCA section 409, which relieves the owner of liability unless the sinking is intentional, and held that the owner was responsible for removal. This court reversed, holding the drydock to be within the meaning of section 409. On appeal, the Supreme Court found that in addition to the in rem rights conferred by section 409, the United States had a right in personam to recover for removal of a vessel negligently sunk and remanded the case to consider this aspect. The court here remanded the case to hear evidence relevant to the negligence issue and to make new findings. Because of the then existing interpretation of section 409, the negligence issue had not been adequately considered by the district court in its initial determination. (Douberley-Florida)
W70-00096

IOWA NATURAL RESOURCES COUNCIL V MAPES (INJUNCTIVE ABATEMENT OF AN UNAUTHORIZED STREAM OBSTRUCTION).

164 NW2d 177-180 (Iowa 1969).

Descriptors: *Iowa, *Streamflow, *Natural flow, *Obstruction to flow, Channel flow, River flow, Channels, Diversion, Dams, Levees, Routing, Streams, Water law, Administrative agencies, Abatement, Flow control, Riparian rights, Riparian land, Legislation, Civil engineering, Judicial decisions, Legal aspects.
Identifiers: Injunction (Mandatory), Nuisance.

Defendants, riparian owners, built a dam which together with a new channel straightened a branch of a river flowing through their property. They did the construction without making the necessary statutory application. Plaintiff Iowa Natural Resources Council sought a mandatory injunction prohibiting defendants from maintaining the obstruction on the basis that the requisite permission had not been obtained for the dam's construction. The trial court dismissed the action. The supreme court affirmed, holding that the Council failed to establish the necessary statutory nuisance so as to entitle it to relief by injunctive abatement. Failure to comply with the statute requiring permission to construct a dam will not per se require injunctive abatement without a clear showing of a nuisance or other situation that requires an injunction. (Helwig-Florida)
W70-00097

STATE PLANNING.

Ark Stat Ann sec 9-319 (Supp 1967).

Descriptors: *Arkansas, *Planning, *Administrative agencies, *Recreation facilities, Developed

waters, Legislation, Operation and maintenance, Parks, Water supply, Recreation.
Identifiers: Water acquisition.

The Arkansas Planning Commission is authorized to initiate and maintain a comprehensive plan for development of the outdoor recreation resources of the state. As an adjunct to the above plan, the Arkansas Publicity and Parks Commission is authorized to develop, operate, and maintain outdoor recreation areas and facilities and to acquire waters interest in waters for such areas and facilities. (Holt-Florida)
W70-00098

BOERNER V MCCALLISTER (NAVIGABLE STREAMS).

197 Va 169, 89 SE2d 23-28 (1955).

Descriptors: *Virginia, *Navigable rivers, *Ownership of beds, Judicial decisions, Boundaries (Property), Navigable waters, Rivers, Streams, Riverbeds, Navigation, Non-navigable waters, Riparian rights, Streambeds, Water law, Fishing, Saw log test.
Identifiers: Trespass, Navigable in fact, Injunctions (Prohibitory).

Defendant trespassed on plaintiff's land to fish in a non-navigable stream. Plaintiff's title to the land was originally granted by the crown and included title to the stream bed, there being no law at the time to prevent the conveyance of river beds. Plaintiff sought to enjoin defendant from trespassing and from fishing in the river. Defendant contended that the river was navigable in fact and open to public use. Beds of non-navigable streams are owned by the riparian owner. The question of navigability is factual. The test being whether the stream is susceptible of being used as a highway for commerce. The burden of proving navigability is upon the one asserting such. The court held that a showing of one unsuccessful effort to float logs during a flood did not carry the burden of proof. The landowner was held to be entitled to a permanent injunction. (Helwig-Florida)
W70-00099

MISSISSIPPI RIVER PARKWAY.

Ark Stat Ann sec 76-1806 (1958).

Descriptors: *Arkansas, *Land, *Right-of-way, United States, Bridges, Bridge construction, Legislation, Administrative agencies, Flood control, Navigation, Bank protection, Levees, Mississippi River, Appropriation.

Arkansas shall acquire and convey to the United States all lands and rights-of-way necessary for connections to the approaches of trans-Mississippi River bridges; subject to such flowage, revetment, bank protection, levee or other river control, harbor line and navigation reservations or rights as the Secretary of War may determine are essential for navigation or flood control purposes. (Holt-Florida)
W70-00100

CONDEMNATION BY COUNTY OR CITY FOR FLOOD CONTROL.
Ky Rev Stat Ann sec 104.010 (1963).

Descriptors: *Kentucky, *Flood control, *Cities, *Condemnation, Legislation, Judicial decisions, Legal aspects, Adjudication procedure, Condemnation value, Land tenure, Real property, Local governments.

Whenever the fiscal court of any county determines that any interest in real property is needed for the purposes of flood control and the fiscal court cannot acquire such interest by agreement with the owners, the fiscal court shall adopt a resolution setting forth the foregoing facts and ordering the condemnation of the required property. The legislative body of any city shall have the same power to condemn real property for flood control purposes as is given to the fiscal court. This section is intended to constitute an alternate method of acquiring property for flood control purposes, in addition to, and not as a substitute for, any other method authorized by law. (Heckerling-Florida)
W70-00101

HESSE V STATE CONSERVATION COMM (IMMUNITY FROM SUITS AGAINST STATE AGENCIES AND SOIL CONSERVATION DISTRICTS).
168 SE2d 293-298 (W Va 1969).

Descriptors: *West Virginia, *Administrative agencies, *Remedies, *Riparian rights, Damages, Land tenure, State governments, Soil conservation, Jurisdiction, Flood protection, Easements, Right-of-way, Access routes, Water law, Dams, Dam construction.
Identifiers: *Soil conservation districts, Injunctions (Mandatory).

Plaintiffs owned land through which a small stream flowed. The state Soil Conservation Committee owned the tract above plaintiffs' land. The Committee granted an easement to the Potomac Valley Soil Conservation District to come upon its land to construct a dam. Since the only access to the dam site was over plaintiffs' land, the Committee obtained a temporary injunction against plaintiffs' interferring with the proposed construction. In order to get heavy equipment to the site, the construction company widened the right of way across plaintiffs' land. Subsequently the court dissolved the temporary injunction and limited the access to the original right of way. Plaintiffs then filed two suits to recover damages and enjoin construction of the flood-prevention dam which plaintiffs claimed would interfere with their lower riparian rights. In answer to certified questions from the court in which the suits were filed, the Supreme Court of Appeals of West Virginia held the Committee to be a state agency having immunity from suit. The court held that the Soil Conservation District could be sued, however, since it was not statewide, but local in scope and nature. The court further found proper venue to be any county within the district. (Harris-Florida)
W70-00102

SUNHILL WATER CORP V WATER RESOURCES COMM'N (REVIEW OF WATER RESOURCES COMMISSION GRANT TO SUPPLY WATER).

301 NYS 2d 935-938 (1969).

Descriptors: *New York, *Water supply, *Administrative decisions, *Permits, Water works, Facilities, Potable water, Water storage, Judicial decisions, Wells, Utilities, Administrative agencies, Water demand, Water policy, Water requirements, Municipal water.

Petitioner, a private domestic water corporation, sought approval from the Water Resources Commission of a plan to supply water to a subdivision. Petitioner's supply system consisted of mains, two 1,000-gallon-per-minute wells, and two 15,000 gallon hydropneumatic storage tanks. The Commission rejected petitioner's plan, concluding that it was not justified by public necessity and that the Suffolk County Water Authority should continue to serve the area with its system of 22 wells, a storage capacity of 5.5 million gallons, water testing facilities, and maintenance crew. On review of the Commission order, the New York Supreme Court held that the conditions attached to the original grant to the Suffolk County Water Authority that they not enter competition with, or parallel the distribution of, any existing waterworks system had not been violated since petitioner was not then in existence or legally assigned to service the subdivision in question. The commission's order was affirmed, and the county water authority was allowed to continue supplying water to the subdivision. (Harris-Florida)
W70-00103

JURGESON V ROMINE (DAMAGES RESULTING FROM OBSTRUCTING THE FLOW OF A CREEK).
For primary bibliographic entry see Field 04C.
W70-00104

STATE PLANNING: MISCELLANEOUS PROJECTS.
Ky Rev Stat Ann sec 147.100 (1963).

Descriptors: *Kentucky, *Project planning, *Administrative agencies, *Water resources development, Legislation, Drainage, Sewerage, Water supply, Surveys, Harbors, Mapping.

The Governor's Cabinet may make maps, planning studies and surveys relating to port, harbor and waterway work, water supply, drainage and sewerage. (Heckerling-Florida)
W70-00105

FISH AND WILDLIFE RESOURCES.
Ky Rev Stat Ann secs 150.010-150.025 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Wildlife conservation, *Resource development, *Administrative agencies, Fish conservation, Legislation, Legal aspects, Fish, Wildlife, Resources, Fishing, Dams, Impounded waters, Navigable waters, Regulation, Conservation, Recreation, Eminent domain, Water policy, Water resources development, Natural resources, Wildlife management.
Identifiers: *Wildlife resources, Public waters.

Included among the terms defined are: 'angling', 'impounded waters', 'navigable waters', 'public waters', 'regulation', 'wildlife', and 'fishing.' 'Navigable waters' are any waters within the state under lock and dam. 'Public waters' are all waters within the state flowing a natural stream channel or impounded on a natural stream. The term 'impounded waters' includes any public waters backed up behind a dam including all water upstream from the dam to the first riffle or shoal. It is state policy to protect and conserve wildlife so as to insure a permanent and continued supply of wildlife resources for the purposes of furnishing sport and recreation. The Department of Fish and Wildlife Resources is established to enforce the laws and regulations adopted under this chapter relating to wildlife and will exercise all powers necessarily incident thereto. The administrative organization and workings of the Department are set out; a commission is created to transact the business of the Department. The commission has extensive regulatory powers enabling it to provide for the conservation of the wildlife of the state. (Keith-Florida)
W70-00106

INTERSTATE WATER SANITATION BOARD.
For primary bibliographic entry see Field 05G.
W70-00107

COUNTY BRIDGE CONSTRUCTION.

Ind Ann Stat secs 36-1901 thru 36-1912 (1949), as amended, (Supp 1968).

Descriptors: *Indiana, *Bridges, *Tunnel construction, *Local governments, Bridge construction, Cities, Streams, Legislation, Highways, Repairing, Grading, Construction, Highways, Tunnels, Navigable waters, Financing, Cost allocation.

The board of commissioners of any county shall direct the repair or construction of highway bridges when required by public convenience. The boards may purchase any toll bridge or buy any interest

therein. Whenever any bridge company abandons any bridge or when the right to take toll has expired, the boards may require the bridge and the grade leading thereto to be repaired. The board of commissioners of every county shall cause all bridges to be kept in repair. The boards may build or repair any bridge within the city limits of any city or town, but the rights of such city or town to build or repair bridges are not thereby impaired. The boards may construct a tunnel under a navigable stream in lieu of a bridge. Any county having three or more second class cities may pay up to fifty percent of the cost of repair, reconstruction, or replacement of any damaged bridge which serves as a main means of ingress and egress for such a city, provided fifty percent of such cost is raised by popular subscription. City and county officials may establish a cumulative bridge fund. (Smith-Florida)
W70-00108

TOWNSHIPS AND COUNTY LINE BRIDGES.
Ind Ann Stat sec 36-2101 (1949).

Descriptors: *Indiana, *Bridge construction, *Local governments, *Boundaries (Property), Bridges, Streams, Legislation, Repairing, Appropriation.

Whenever a petition which is signed by twenty-five freeholders of any township which is bounded by a stream forming the boundary line between two counties is presented to the board of commissioners of any county, and such petition asks such township to make an appropriation for the construction or repair of a free bridge for highway purposes only across such stream, the board of commissioners shall enter such petition in their records. (Smith-Florida)
W70-00109

FERRIES ON STREAMS BORDERING STATE.
Ind Ann Stat secs 36-2501 thru 36-2513 (1949), as amended, (Supp 1968).

Descriptors: *Indiana, *Regulation, *Permits, *Transportation, Administrative decisions, Administrative agencies, Maintenance, Rivers, Streams, Lakes, Ohio River, Damages, Legal aspects, Legislation, Rates, Local governments, Navigation, Boats.
Identifiers: *Penalties (Criminal), *Ferries, *Ferry regulation.

A license must be acquired from the appropriate county or city officials before any public ferry may be operated on a stream connecting Indiana with any point without the state. Applicants for licenses must post public notice of their application. The respective officials may issue five-year licenses provided the licensee posts a bond which will insure regular ferry service and maintenance. Unlicensed ferriage across the Ohio or Wabash rivers subjects one to pay damages to the licensed ferry unless enumerated circumstances exist. Cities issuing ferry licenses are authorized to fix rates, set rules of operation, and schedule the operations of said ferries. Licenses may be vacated by the cities granting them if cause is shown. Licensees who violate either city or county license conditions shall be guilty of a misdemeanor and subject to a fine upon conviction. (Holt-Florida)
W70-00110

INDIANA STATE TOLL BRIDGE COMMISSION.

Ind Ann Stat secs 36-3002, 36-3004, 36-3005, 36-3006, 36-3006a, 36-3007 (1949), as amended, (Supp 1968).

Descriptors: *Indiana, *Bridges, *Administrative agencies, *Interstate rivers, Administrative decisions, Bridge construction, Rivers, Streams, Legislation, Public benefits, Riparian rights, Investigations, Eminent domain, United States, Condemnation, Interstate, Appropriation.
Identifiers: *Ferries.

The Indiana State Toll Bridge Commission is authorized and empowered to construct and/or acquire by purchase or condemnation highway bridges and their approaches over and across any river or stream bounding the state whenever said bridge or approach will extend into Indiana. This act applies notwithstanding the fact that such stream is partially or wholly within a bordering state. The Commission is authorized to make investigations to determine if the above constructions or acquisitions would be in the public interest. To facilitate such investigations, engineers and other professionals may be retained. When and if the Commission determines that construction or acquisition of an interstate bridge is in the public interest, they shall make a resolution declaring such determination. The Commission is authorized to purchase all lands and riparian rights necessary for construction or acquisition of said bridges. The Commission shall purchase at a fair price any ferry that has operated continuously for 15 years within 2 miles of a proposed bridge site. The Commission is given the power of eminent domain. (Holt-Florida)
W70-00111

PROSPECTING AND DEVELOPMENT OF RIVER BEDS, LAKE BEDS AND SHORE LANDS.
For primary bibliographic entry see Field 03E.
W70-00112

SEWERS AND DRAINS IN CITIES AND TOWNS.

Ind Ann Stat secs 48-3915 thru 48-3923 (1963).

Descriptors: *Indiana, *Sewage, *Drainage systems, *Sewage disposal, Legislation, Legal aspects, Cities, Leases, Contracts, Construction, Maintenance, Drains, Sewers, Cost allocation, Bids, Taxes, Assessments, Pumping plants, Water purification, Public health, Environmental sanitation, Financing, Projects, Administration.
Identifiers: *Joint projects.

Any city or town may build or otherwise acquire a general sewage system together with all the property rights and privileges connected therewith; cities and towns may also purchase or lease other lands for erecting pumping stations or other buildings in connection with said sewage system. Methods of financing, voter approval, and payment of taxes for such systems are specifically enumerated. The terms 'sewer', 'drain', 'sewerage and drainage system' and 'drainage or sewerage facilities' are construed to mean and include any local, main, collateral, connecting or interceptor sewer or drain, or any system, works, plant or other structure necessary for the collection, treatment, filtration, purification or sanitary disposal of the sewage and drainage of such cities and towns. Provision is made for the joint acquisition or construction of sewage systems or parts thereof by adjoining cities; the administrative procedures to be used in reaching agreement, cost allocation, bid advertisement, contract letting and financing for all such joint efforts are provided. (Keith-Florida)
W70-00113

INTERSTATE PORT DISTRICT OF ILLINOIS AND INDIANA.

Ind Ann Stat secs 68-401 thru 68-405 (1961).

Descriptors: *Port authorities, *Interstate commissions, *Illinois, *Indiana, State governments, Harbors, Great Lakes Region, Lake Michigan, Mississippi River, Programs, Administrative agencies, Legislation, Interstate compacts, Transportation, Navigation, Breakwaters, Engineering structures.
Identifiers: *Commercial development, Water terminals, Port and waterway development, Port districts.

This act witnesses a compact between Indiana and Illinois that creates a governmental body to coordinate port and waterway development programs in the Chicago-Lake Michigan area. Within the agreement's thirteen articles are provisions for the jurisdiction, specific powers, and duties of the port authority. The port district consists of the waters of Lake Michigan within the respective boundaries of the two states and all of the rivers common to the states, including all harbors, piers, breakwaters, and structures therein. The port authority is given the power to acquire, own, construct, lease, operate, and maintain such port and water terminal facilities as are specifically authorized by the legislature of either state. The duties of the port authority are to study, prepare, and recommend by specific proposals such changes and modifications as may be required to develop and maintain a full development of commerce in the port district. Both states pledge mutual cooperation and agree to share the expenses of the port authority except for the creation of a terminal facility within one of the states. (Schram-Florida)
W70-00114

REGISTRATION OF MOTORBOATS.

Ind Ann Stat secs 68-1101 thru 68-1110 (1961), as amended, (Supp 1968).

Descriptors: *Indiana, *Boating regulations, *Legal aspects, *Boats, Regulations, Safety, Federal government, State governments, Conservation, Jurisdiction, State jurisdiction, Bodies of water, Legislation, Administrative agencies.
Identifiers: Registrations.

Every motorboat operating on the waters of the state must be registered with the Department of Conservation and numbered. A registration must be renewed every three years. Boats numbered under a federally approved numbering system using state waters for less than ninety consecutive days need not register in this state, nor do motorboats of the United States, a state, or a subdivision thereof. Every peace officer of the state and any conservation officer may enforce this act. Violations of this act are a misdemeanor. (McDonough-Florida)
W70-00115

INDIANA PORT COMMISSION.

Ind Ann Stat secs 68-1201 thru 68-1227 (1961), as amended, (Supp 1968).

Descriptors: *Indiana, *Port authorities, *Construction, *Financing, Federal government, Lake Michigan, Riparian rights, Harbors, Canals, Canal construction, Docks, Capital costs, Construction costs, Government finance, Eminent domain, Taxes, Income, Transportation, Legal aspects, Legislation, Planning, Public utilities, Administrative agencies.

The Indiana Port Commission is a five-member commission appointed by the Governor to construct a modern port with terminal facilities for all forms of transportation on Lake Michigan and/or on the Ohio River in designated counties. The Commission is authorized to issue revenue bonds to finance construction. The general powers of the Commission include: (1) the preparation of plans and contracts for port facilities; (2) the acquisition of land by purchase, lease, and eminent domain; (3) the relocation of public roads, railroad and public utility facilities which shall be payable as costs of construction; (4) the issuance of port revenue bonds, which are not to be considered debts of the state; and (5) the setting of fees and charges. All income is to be considered trust funds for port purposes. The Commission and its bonds are given certain tax exemptions. The Commission is authorized to apply for permission to operate a foreign-trade zone and to construct canals and waterways. (McDonough-Florida)
W70-00116

FISHING THROUGH ICE HOLES.
Ind Ann Stat secs 11-1615, 11-1615a (Supp 1968).

Descriptors: *Indiana, *Fishing, *Regulation, *Ice fishing, Legislation, Legal aspects, Permits, Lakes, Rivers, Streams, Structures, Obstruction to flow, Fishing gear, Permits, Water utilization, Fish conservation, Water conservation.
Identifiers: Penalties (Criminal), Fishing licenses.

It is unlawful to fish in any of the lakes, rivers, or streams of the state through more than two holes in the ice at one time or through a hole more than twelve inches in diameter. Any structure used in such fishing must meet specified requirements and must be removed from the ice before the ice melts. Fishing licenses and permits issued to nonresidents whose home states do not allow nonresidents to fish through the ice shall not be deemed to permit the holder thereof to fish through the ice. Violators of this provision are subject to criminal penalties. (Keith-Florida)
W70-00117

FISH LADDERS - REGULATIONS.

Ind Ann Stat secs 11-1617, 11-1618 (1956).

Descriptors: *Indiana, *Fish ladders, *Dams, *Regulation, Legislation, Rivers, Watercourses (Legal), Cities, Construction costs, Maintenance, Legal aspects, Repairing, Fish migration.
Identifiers: Liens.

The owners of any dam which is over four feet in height and which crosses any watercourse of this state shall construct and maintain fish ladders on such dam to allow fish below the dam to travel to the waters above the dam. If the owner does not erect the ladders, the trustee of the township where the dam is located may construct such ladders, and the cost shall constitute a lien on the dam. If the owner continues to refuse to pay the cost of the ladders, the trustee may sue to recover the amount and may foreclose the lien on the dam. The owners shall be required to keep the ladders in good repair. The trustee of the township, after 30 days notice to the owner, may make such repairs if the owner fails to do so. He may recover the costs as provided above. It shall be unlawful to fail to repair the fish ladders required under these provisions. (Heckerling-Florida)
W70-00118

MUSSELS - REGULATIONS.

Ind Ann Stat secs 11-1644 thru 11-1648 (1956).

Descriptors: *Indiana, *Mussels, *Wildlife conservation, *Regulation, Legislation, Wildlife management, Commercial shellfish, Shellfish, Fishing gear, Beds under water, Breeding, Commercial fishing.
Identifiers: Breeding grounds.

No person shall catch, possess, or sell any mussel less than two inches in size. Any mussel smaller than the above size shall be culled and immediately returned to the water. Only one boat or rig for taking mussels may be operated by one person at any time. No crowfoot bar, dredge, fork, shovel, or spade, or any other device used in scraping, digging, spading, or otherwise disturbing the bed of any waters, shall be used in taking mussels from April 1 through June 13. The Wabash River shall be exempted from this section for purposes of the use of the above devices. It shall be unlawful to have more than the herein prescribed numbers of certain devices used in taking mussels. Certain waters may be designated as breeding grounds for mussels from which mussels shall not be taken for designated periods of time. Limits are prescribed for the sizes of breeding grounds. Notice of such regulation shall be made public in the prescribed manner. No person shall take or kill mussels in any area or parts of the waters of this state closed during the time prescribed by regulation. (Heckerling-Florida)
W70-00119

OPEN SEASON AND BAG LIMITS.

Ind Ann Stat secs 11-1701 thru 11-1708 (1956).

Descriptors: *Indiana, *Regulation, *Wildlife conservation, *Administrative decisions, Legislation, Legal aspects, Fish, Frogs, Mussels, Reproduction, Conservation, Fish conservation, Lakes, Streams, Rivers, Ponds, Bodies of water, Administrative agencies, Wildlife, Wildlife management.
Identifiers: *Open seasons, *Bag limits, Penalties (Criminal).

Seasons and limits on fish, frogs, mussels, game, fur bearing animals and game birds, as well as regulations for the taking and killing thereof are established. The Director of the Department of Conservation may, however, modify such seasons, limits, and regulations in the interest of wildlife conservation. Any decision of the Director to modify statutory seasons, limits, and regulations must be based on an investigation reflecting the production, preservation, and propagation of the species involved. Criminal penalties are provided for the violation of any regulation or order of the Director. The term 'waters' is defined to include any lake, stream, river, pond, or body of water and all chains, systems, or combinations thereof within the state. (Keith-Florida)
W70-00120

STATE COOPERATION IN FEDERAL WILDLIFE CONSERVATION PROJECTS.

Ind Ann Stat secs 11-1901 thru 11-1902, 11-1904 (1956).

Descriptors: *Indiana, *Fish reproduction, *Migratory birds, *Wildlife conservation, Legislation, Legal aspects, Drainage, United States, Federal government, Jurisdiction, Fish conservation, Administrative agencies, Permits, Treaties, Lakes, Streams, Multiple-purpose projects, Federal reservations, Conservation, Project purposes, Water policy, Federal project policy.
Identifiers: *Fish restoration, *Federal-state cooperation, Federal projects.

The United States may acquire such lands and water in the state as it deems necessary for the establishment of migratory-bird reservations in accordance with the federal migratory-bird treaty of 1929. The treaty's purpose is to lessen the dangers threatening migratory game birds from drainage and other causes. The United States commissioner of fisheries may conduct fish hatching operations and related investigations within the state in order to promote fish culture and to increase the number of useful food and game fishes in the lakes and streams of the state. The state assents to an act of Congress providing for aid to the states in fish restoration and other management projects. The director of the division of fish and game may perform such acts as may be necessary to establish cooperative fish restoration projects. No funds accruing to the state from fishing license fees may be diverted for any other purpose than the administration of the division of fish and game and for the protection, propagation, and investigation of fish and game. (Keith-Florida)
W70-00121

WATERCOURSES - CANALS - TOLL BRIDGES.

Ind Ann Stat secs 26-1413 thru 26-1417 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Channel improvement, *Stream improvement, *Cleaning, Obstruction to flow, Canals, Appropriation, Repairing, Legislation, Non-navigable waters, Channels, Financing, Administrative agencies, Local governments, Costs, Maintenance costs.
Identifiers: Toll bridges, counties.

The Board of County Commissioners of any county may, for the purpose of navigation, appropriate money for canal repair. The Board may purchase any toll bridge or private interest therein. Upon petition by owners of frontage land bordering on any non-navigable stream requesting that a specified portion of such stream be cleaned or improved to provide adequate capacity, the Board shall refer such petition to the county surveyor for examination. The Board may also determine, in the absence of petition, that such stream needs cleaning or improving. After a hearing, the Board may provide that necessary work be performed by the county or let for contract. Commencement of such work is subject to approval of the County Council which shall make an appropriation to cover the costs thereof. This act shall not apply to ditches or drains already established by a court and for which a maintenance district exists. Where the non-navigable stream forms a boundary between two counties, the petition to improve shall be filed with both counties. The boards of the counties shall proceed in joint action and the costs shared equally. (Marsee-Florida)
W70-00122

PROTECTION OF LAKES.
For primary bibliographic entry see Field 04A.
W70-00123

WATER LEVEL PROTECTION.
For primary bibliographic entry see Field 04A.
W70-00124

WATER LEVEL PROTECTION.
For primary bibliographic entry see Field 04A.
W70-00125

WATER LEVEL STABILIZATION.
For primary bibliographic entry see Field 04A.
W70-00126

WATER LEVEL PROTECTION (LAKES).
For primary bibliographic entry see Field 04A.
W70-00127

STUDY OF WATER RESOURCES AND MANAGEMENT.
For primary bibliographic entry see Field 06B.
W70-00128

MAINTENANCE OF DAMS, LEVEES AND FLOOD CONTROL WORKS.

Ind Ann Stat secs 27-1801 thru 27-1808 (Supp 1968).

Descriptors: *Indiana, *Flood control, *Operation and maintenance, *Flood protection, Diversion structures, Dams, Levees, Construction, Water management (Applied), Watershed management, Planning, Engineering structures, Dam construction, Design, Costs, Construction costs, Assessments, Taxes, Inspection, Surveys, Legislation, Legal aspects.
Identifiers: Penalties (Criminal).

The owner of any dam, levee, dike, or floodwall and appurtenant works must keep the structure in repair and/or satisfactory operating condition. The Indiana Flood Control and Water Resources Commission is charged with supervision over the status of repair of such structures and may make rules and regulations for their maintenance and operation. The Commission may vary these standards where location of the structure or particular hazzards involved so require. The Commission is directed to make annual engineering inspections of all dams, levees, dikes, and floodwalls with certain exceptions noted in the statute. The Commission may order such repairs or reconstruction of defective works as are required to meet its standards. In emergencies, where life and property are endangered, the Commission may take steps to provide

emergency protection and may recover the costs for same from the owner. Refusal to comply with Commission repair orders may subject the owner to prosecution for a misdemeanor. The Commission may enter land for engineering inspections without liability for trespass and is exempt from liability for injury arising from faulty construction or repair of dams and other works or from issuance and enforcement of any lawful order. (Kelly-Florida)
W70-00129

RESERVOIR SITES FOR STORAGE OF WATER.

Ind Ann Stat secs 27-1901 thru 27-1908 (Supp 1968).

Descriptors: *Indiana, *Water conservation, *Water management (Applied), *Water storage, Water yield improvement, land use, Easements, Water demand, Water utilization, Reservoirs, Reservoir operation, Water allocation (Policy), State governments, Legal aspects, Legislation, Water sources, Costs, Flood control, Water control, Water resources, Condemnation, Administrative agencies, Local governments.

Municipalities, Taxing districts, and public utilities may secure reservoir sites for future needs which are determined by factors including growing domestic and other uses of water, pollution control, and flood control and prevention. The state Flood Control and Water Resources Commission is empowered to purchase or condemn lands or interests in land for reservoirs and to construct structures for water impoundment. This may be done on behalf of the state or any municipality, taxing district, or public utility which has the right and duty to store water for purposes stated in this statute. The owner of any land from which an easement or remainder interest is taken may use the land for recreational, agricultural, or other purposes, subject to the dominant purpose of water storage. The state Board of Health and the Commission must approve the taking of land for the purposes of this act by any party other than the Commission. (Kelly-Florida)
W70-00130

INDIANA DRAINAGE CODE - DRAINAGE BOARDS - POWERS AND DUTIES.
Ind Ann Stat secs 27-2001 thru 27-2017 (Supp 1968).

Descriptors: *Indiana, *Drainage programs, *Drainage practices, *Planning, Operation and maintenance, Maintenance, Construction, Construction costs, Maintenance costs, Assessments, Regulation, Design standards, Specification, Local governments, Legislation, Drainage engineering, Surveys, Surface drainage, Legal aspects, Classification, Administrative agencies, Administration, Repairing.
Identifiers: *Drainage boards.

County drainage boards are established in each county of the state. Membership includes county commissioners, the county surveyor, and a city engineer in appropriate cases. The county surveyor is the technical authority on construction and maintenance of all legal drains in the county and is responsible for investigation and planning of needed improvements and for preparing standards of design, construction, and maintenance applicable to all legal drains. The surveyor must supervise all work on improvements and maintain complete records concerning all legal drains in the county. The surveyor is charged with maintaining a classification system of all drains in the county with regard to maintenance and reconstruction needs and desirability of vacating drains. The statute sets forth criteria for classification, gives examples of types of needed repair which may be made, and outlines the manner in which repair or vacating may be accomplished. Costs of public drain improvements may be assessed against benefited land owners, the pro rata share to be determined by the board. A joint board will preside over proceedings involving improvements affecting land in two or more counties. (Kelly-Florida)
W70-00131

CONSTRUCTION OF DRAINS.

Ind Ann Stat secs 27-2101 thru 27-2166 (Supp 1968).

Descriptors: *Drains, *Indiana, *Drainage engineering, *Drainage programs, Drainage practices, Drainage, Land management, Costs, Construction costs, Drainage effects, Surface drainage, Drainage systems, Cost allocation, Damages, State governments, Local governments, Legal aspects, Legislation, Planning, Cost-benefit theory, Estimated costs, Construction, Maintenance, Administrative agencies, Maintenance costs, Administration, Surveys, Assessments.

Where establishment of a new legal drain cannot be easily accomplished without affecting other property, owners of land affected by the proposed improvement may petition the drainage board for the establishment of the new drain. Petitions may also be filed by county commissioners for highway drainage, by school trustees for drainage of public school grounds, or city officials for drainage with the corporate limits. The statute sets forth the necessary content of the petition, procedure for filing, and procedure to be followed by the board in hearing, investigating and deciding petitions. The county surveyor shall, at the board's request, determine the type of drainage structure to be used, prepare plans for construction, and determine costs. The board may, after proper hearings, assess costs against the benefited landowners. The board may refer to the surveyor those drains in need of reconstruction or those drains in need of periodic maintenance for reports by him concerning plans for reconstruction or maintenance, and estimates of costs, including damage awards, which may be assessed against benefited landowners after public hearings. (Kelly-Florida)
W70-00132

DRAIN IMPROVEMENT.
Ind Ann Stat secs 27-2401 thru 27-2420, 27-2501 thru 27-2507 (Supp 1968).

Descriptors: *Indiana, *Drainage systems, *Costs, *Local governments, Drainage, Ditches, Drainage programs, Drainage districts, Controlled drainage, Maintenance, Maintenence costs, Construction costs, Replacement costs, Cost allocation, Cost-benefit analysis, Cost sharing, Legislation, Assessments, Tile drains, Financing, Operation and maintenance.

There is created in each county a general drain improvement fund which shall be used to pay the cost of constructing, reconstructing, or maintaining a legal drain. A maintenance fund is created for each legal drain. The county auditor shall set up a separate account for each drain and shall assess the lands benefited for the periodic maintenance costs. When even the cost of maintaining any tile drain does not exceed one hundred dollars, such drain may be exempted from this act, and the costs shall be paid from the general drain improvement fund. Bonds may be issued and redeemed to finance such maintenance. The drainage board has the power to contract for improvement and maintenance work. The board shall apportion all costs to the several tracts of land benefited. A ditch assessment lien shall attach to the lands assessed on the date of certification of the final assessment. Whenever the cost is more than can be conveniently paid by assessment, the sale of bonds shall be authorized. Any owner of land affected by a final order of a drainage board shall be entitled to judicial review thereof. (Smith-Florida)
W70-00133

RIVER IMPROVEMENTS BY THE UNITED STATES.
Ind Ann Stat secs 62-1007, 62-1010 (1962).

Descriptors: *Indiana, *Navigable rivers, *Condemnation, *United States, Legal aspects, Legislation, Rivers, Locks, Dams, Chutes, Abuttments, Structures, Construction, Maintenance, Navigation, Jurisdiction, Ohio River, Banks, Federal government, Dam construction.
Identifiers: *River improvements.

The United States may acquire any property for the purpose of erecting thereon dams, abuttments, locks, lock-keepers' houses, chutes, and other structures necessary for the construction and maintenance of slack water navigation on navigable rivers. The consent of the state to such acquisition is contingent on the beginning by the United States of the improvement of a navigable river within or bordering upon the state. Such acquisition may be either by purchase or condemnation. The United States is granted specific permission to purchase any land on the banks of the Ohio or Wabash rivers provided that it is purchased to erect thereon structures necessary to the improvement of said rivers. (Keith-Florida)
W70-00134

DUTIES OF THE DEPARTMENT OF CONSERVATION.
For primary bibliographic entry see Field 05G.
W70-00135

CONSERVATION DEPARTMENT.

Ind Ann Stat secs 60-725a, 60-736, 60-737, 60-748 thru 60-750 (1962).

Descriptors: *Indiana, *Surface waters, *Water conservation, *Flood control, Legislation, Legal aspects, Artificial watercourses, Conservation, Condemnation, Eminent domain, Recreation facilities, Streams, Obstruction to flow, Lakes, Rivers, Water levels, Drainage, Navigable rivers, Navigable waters, Non-navigable waters, Administrative agencies, Public benefits, Federal government.
Identifiers: *Man-made lakes.

The Department of Conservation may acquire surface water rights on certain man-made lakes. With certain restrictions the Department may also acquire land adjacent to such man-made lakes for purposes of public access and recreation. The Department must approve all plans for flood control projects before work on them begins. The Department of Conservation by itself or in conjunction with the federal government must clean out, straighten, deepen, widen, remove obstructions from, and clear the banks of specified portions of the Little Calumet River. The Department is empowered to become a party to any legal action in any state court when such action affects the preservation or maintenance of the lakes, rivers, or streams of the state; all state courts must recognize this right of the Department. The definition of 'lakes' includes both meandered and unmeandered lakes, and the term 'rivers' is defined to include both navigable and nonnavigable rivers and streams. (Keith-Florida)
W70-00136

BANKS V CHICAGO MILL AND LUMBER CO (ACCRETIONS TO RIPARIAN LAND).

92 F Supp 232-242 (ED Ark 1950).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Boundaries (Property), Judicial decisions, Bank erosion, Avulsion, Boundary disputes, Islands, Navigable rivers, Rivers, Shores, Banks, Riparian land, Riparian rights, High water mark, Water rights, Sedimentation, Stream erosion, Severance.

Both parties claim title to riparian land. Defendant's claim is based on evidence that the land had been formed as accretions to the bank of the river and subsequently separated therefrom by avulsive change of the river. Plaintiff claims that the land had moved from one bank of the river to the op-

posite by avulsion and later moved back by subsequent avulsion. A riparian owner whose land is added to by gradual and imperceptible accretion gains title to the new land. He also loses land washed away by gradual erosion. However, where a stream suddenly changes course by avultive action the riparian owner retains title to submerged land or island if one is formed. Avulsion causes no change in boundaries. The court found that the land in question formed by the gradual deposit of silt and sediment was later to be cut off from the bank by avulsion of the river establishing defendant's title. (Helwig-Florida)
W70-00165

PANTHER COAL CO V LOONEY (MINE WATER POLLUTION).
For primary bibliographic entry see Field 05G.
W70-00167

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-00168

ARMSTRONG V FRANCIS CORPORATION (REPULSION OF SURPLUS WATER).
For primary bibliographic entry see Field 04A.
W70-00169

ACCRETION - A NEW SLANT,
For primary bibliographic entry see Field 04A.
W70-00170

CHICAGO SANITARY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00171

CHICAGO SANITARY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00172

CHICAGO SANITARY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00173

CHICAGO SANITARY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00174

CHICAGO SANITARY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00175

GIANT FOOD INC V WASHINGTON-ROCKVILLE INDUSTRIAL PARK INC (DAMAGES FROM DRAINAGE).
For primary bibliographic entry see Field 04C.
W70-00176

STRIP MINING.
For primary bibliographic entry see Field 05G.
W70-00177

TENNESSEE RIVER BASIN WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W70-00178

WATER WELL DRILLERS.
For primary bibliographic entry see Field 04B.
W70-00179

TREATIES AND RIGHTS OF TRANSIT ON THE ST LAWRENCE,
For primary bibliographic entry see Field 04A.
W70-00180

TORTS - NUISANCE: INTERESTS WHICH WILL SUSTAIN A NUISANCE ACTION,
For primary bibliographic entry see Field 05G.
W70-00181

EXTENT OF PRIVATE RIGHTS IN NON-NAVIGABLE LAKES,
For primary bibliographic entry see Field 04A.
W70-00182

RIPARIAN RIGHTS IN GEORGIA,
For primary bibliographic entry see Field 04A.
W70-00183

A STATE STATUTE TO POVIDE CONTROLS FOR EQUITABLE DISTRIBUTION OF WATER.
For primary bibliographic entry see Field 06D.
W70-00184

WATER LEGISLATION,
For primary bibliographic entry see Field 06D.
W70-00185

RIVERS STREAMS AND WATERWAYS.
For primary bibliographic entry see Field 05G.
W70-00186

MUENCH V PUBLIC SERVICE COMMISSION (DELEGATION OF LEGISLATIVE POWER OVER MATTERS OF STATE-WIDE INTEREST).
261 Wis 492, 55 NW2d 40-48 (1952).

Descriptors: *Wisconsin, *Public benefits, *Navigable waters, *Public rights, Administrative agencies, Judicial decisions, Local governments, Dams, Dam construction, Navigation, Hunting, Fishing, Scenery, Legal aspects, Water law, Water policy, Competing uses, Governments, Recreation, Water allocation (Policy), Water resources development.
Identifiers: *Delegation doctrine.

Petitioner was granted a rehearing on a petition to review the decision of the Public Service Commission which authorized the construction of a dam. The issue on rehearing was the constitutionality of the statute under which the Commission had authorized said construction. Petitioner contended that the statute was void as an improper delegation of legislative power because it attempted to delegate to the county boards the power to determine the effects of dam construction on the public right to the enjoyment of fishing, hunting, and scenic beauty which are matters of state-wide not local concern. The court held this statute unconstitutional as an unlawful delegation of legislative authority and as constituting a complete abdication of the public trust doctrine under which the state holds all navigable waters in trust for the public. This trust extends to the use of such waters for fishing, hunting, and other recreational purposes, as well as to pure navigation. The right to hunt and fish are matters of state-wide concern over which the power to legislate cannot constitutionally be delegated to county boards. The previous mandate of reversal was affirmed. (Johnson-Florida)
W70-00187

SMITH V SPEERS (CONDEMNATION OF PROPERTY FOR CONSERVATION OF ATLANTIC SEA RUN SALMON).
For primary bibliographic entry see Field 03E.
W70-00188

FLOOD CONTROL AND WATER USAGE.
For primary bibliographic entry see Field 04A.
W70-00189

SEWERS AND DRAINS IN CITIES AND TOWNS.
For primary bibliographic entry see Field 04C.
W70-00190

NAVIGABLE WATERWAYS.
For primary bibliographic entry see Field 04A.
W70-00191

CHICAGO REGIONAL PORT COMMISSION.
For primary bibliographic entry see Field 04A.
W70-00192

WABASH VALLEY COMPACT.
For primary bibliographic entry see Field 04D.
W70-00193

PORT AUTHORITIES.
For primary bibliographic entry see Field 04A.
W70-00194

DAMS AND OBSTRUCTIONS - PROTECTION OF FISH.
For primary bibliographic entry see Field 04A.
W70-00195

OHIO RIVER AREA COORDINATING COMMISSION.
For primary bibliographic entry see Field 06B.
W70-00196

LEVEE AUTHORITY DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00197

WATER RIGHTS.
For primary bibliographic entry see Field 04C.
W70-00198

FISH AND WILDLIFE RESOURCES.
For primary bibliographic entry see Field 03E.
W70-00199

FLOOD CONTROL SYSTEMS.
For primary bibliographic entry see Field 04A.
W70-00200

FISH AND GAME (FISHING REGULATIONS).

Ark Stat Ann secs 47-401 thru 47-420 (1964).

Descriptors: *Arkansas, *Fish, *Sport fishing, *Commercial fishing, Legislation, Regulation, Recreation, Fresh water fish, Fish, Bass, Perch, Salmon, Pikes, Trout, Minnows, Fishing equipment, Bait fishing, Nets.
Identifiers: *Penalties.

Arkansas regulations concerning game fish are set forth. Provisions concerning bait, minimum length, and string limit are provided. Minnow regulations include closed season provisions, exportation, seine and licensing restrictions. The use of hook and line, traps, gigs, spears, explosives, and intoxicating substances to take fish is restricted. Licensing and the use of seines, trammel and gill nets for commercial fishing are regulated. Provisions concerning the use of hoop, barrel, or pond nets and penalties for violations thereof are included. Specific geographic and date limitations on the use hoop nets and commercial troutlines, snag lines, gigs, or spears, together with licensing provisions are set forth. Predatory fish removal and control provisions are included. (Moulder-Florida)
W70-00212

DRAINAGE IMPROVEMENT DISTRICTS; REMOVAL OF STREAM OBSTRUCTIONS.
For primary bibliographic entry see Field 04A.
W70-00225

FISH AND GAME (MUSSELS)

Ark Stat Ann secs 47-601 thru 47-604 (1964).

Descriptors: *Arkansas, *Mussels, *Mollusks, *Shellfish, Clams, Regulation, Legislation, Administration, Boats, Dredging, Fishing gear, Fishing equipment, Commercial fishing, Taxes, Wildlife management, Administrative agencies.
Identifiers: *Penalties.

Arkansas mussel takers and buyers must conform to certain regulations. An annual shell taker's license must be procured, under which the possessor may operate not more than one boat or rig for taking mussels plus one boat for towing. It is unlawful to use more than two crow feet bars or one dredge. Minimum size restrictions are set forth. In addition persons buying mussel shells must procure a license from the fish and game commission. Every person who runs a boat for the purpose of dealing in fresh-water mussel shells shall procure a license. The holder of a shell buyer's license must make an annual report to the fish and game commission. There is no severance tax. The Arkansas game and fish commission shall enforce these laws. The commission may also set up restricted areas where mussel fishing is prohibited. Penalties for infractions are provided. (Moulder-Florida)
W70-00236

UTILITIES AND INDUSTRIES CORP V STATE (EMINENT DOMAIN).

24 NYS2d 756, 299 NYS2d 851-852 (1969).

Descriptors: *New York, *Eminent domain, *Water policy, *Damages, Water law, Condemnation, Legal aspects, Right-of-way, Water rights, Adjudication procedure, Appropriation, Preferences (Water rights), Prescriptive rights, Administrative agencies, Competing uses, Relative rights, Water supply.

Respondent state took a strip of land from appellant for purposes of a controlled access highway which left appellant with land on both sides of the highway. While appellant retained access to the land east of the highway, the superintendant of public works gave access to land west of the road only if appellant used such land for public water supply purposes. The court held that the landowner was entitled to consequential damages, but that access to the western portion of the property could be conditioned on the continued use of the land as a public water supply. (Johnson-Florida)
W70-00238

MILLS AND MILL DAMS.
For primary bibliographic entry see Field 04A.
W70-00245

JOINT OPERATION OF WATER SOURCES.
For primary bibliographic entry see Field 03D.
W70-00276

BRIDGES, CULVERTS, SEWERS AND WATERCOURSES IN SECOND CLASS CITIES.
Ky Rev Stat Ann sec 84.170 (1963).

Descriptors: *Kentucky, *Bridges, *Cities, *Watercourses (Legal), Culverts, Sewers, Legislation, Administrative agencies, Financing, Administrative decisions, Maintenance, Regulation, Flow augmentation, Alteration of flow, Channel improvement, Channel flow, Artificial watercourses, Natural streams, Legal aspects, Operation and maintenance.

The general council of any second class city may by ordinance: (1) acquire, erect, and maintain bridges within the city and from the city across any watercourse bounding the city; (2) establish, erect, maintain, and regulate the use of culverts and sewers; (3) establish, alter, deepen, and change the channel of watercourses, both natural and artificial, and wall up and cover such watercourses if necessary. (Heckerling-Florida)
W70-00301

ORGANIZATION AND GOVERNMENT OF CITIES-THIRD CLASS.
For primary bibliographic entry see Field 03D.
W70-00304

WATERS AND WATERCOURSES - FISHING - RIGHT OF PUBLIC IN FLOATABLE STREAMS.
Mich L Rev, Vol 42, No 4, p 712-713, Feb 1944. 2 p, 5 ref.

Descriptors: *Michigan, *Navigable waters, *Ownership of beds, *Public benefits, Riparian rights, Fishing, Streambeds, Non-navigable waters, Relative rights, Prescriptive rights, Judicial decisions, Public rights, Easements, Competing uses, Legal aspects.
Identifiers: *Common law.

This comment is based on an action brought to compel the defendants to restore the bed of a stream flowing through their land to its former condition. The stream was thirty feet in width and averaged in depth approximately one foot. It had a flow of less than fifty cubic feet per second. The stream was not capable of 'commercial travel by any kind of boat', and it was doubtful whether it was 'practical to use a boat on it in fishing.' Although in logging days some loose timber had been floated down it, the stream could never be used to float logs without the use of dams. The court ruled that barriers and holes placed in the stream to prevent waders from entering defendants' land must be removed. Michigan law thus seems settled that the public right of fishing extends even to floatable streams, the beds of which are owned privately. Thus, Michigan and Wisconsin go against the common law rule that the right to fish follows ownership of the bed rather than navigability. Seemingly, capability of use for floating rather than actual use therefore is the determinative factor. (Schram-Florida)
W70-00315

EMINENT DOMAIN.

Ky Rev Stat Ann secs 416.130, 416.140, 416.220 (1963), as amended, (Supp 1968).

Descriptors: *Public utilities, *Dams, *Kentucky, *Eminent domain, Condemnation, Electric power, Navigation, Streams, Highways, Water delivery, Pumping, Legislation, Overflow, Flood damage, Right-of-way, Access routes, Water supply, Easements.

Every corporation organized for the purpose of constructing a dam to improve navigation or to provide water power or electricity when unable to reach an agreement with the owner of needed lands or rights, may condemn the needed property. A corporation maintaining such a dam shall be liable in damages for any overflow. Any company transmitting or selling electricity, gas, or gasoline may acquire rights of way for fixtures and appliances so as to be able to distribute said products to consumers. These fixtures shall not obstruct navigation or travel. An owner of real estate serving the public shall have the right to acquire a right of way to the nearest river or water supply line if adequate water is not available on the property. (Darragh-Florida)
W70-00329

COUNTY LINE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00336

FIRESTONE TIRE AND RUBBER CO V RITCHIE (CONDEMNATION PROCEEDINGS AGAINST PERSONALTY NOT AUTHORIZED).
168 SE2d 287-293 (W Va 1969).

Descriptors: *West Virginia, *Condemnation, *Remedies, *State governments, Administrative agencies, Flood damage, Highway relocation, Relative rights, Flooding, Shafts (Excavations), Judicial decisions.
Identifiers: *Sovereign immunity, Abandoned mines.

Plaintiff corporation leased a store in which it kept and sold large amounts of personal property merchandise. The state road commission of West Virginia entered a contract with a construction company to relocate a highway. In the process of relocating, the mouth of an abandoned mine was opened by excavations causing the release of impounded water which flooded plaintiff's leasehold, damaging its personal property. Since the state road commission, as a state agency, was immune to tort suit, plaintiff sought mandamus to compel the defendant commissioner to institute condemnation proceedings against plaintiff's damaged property. On appeal from an order upholding defendant's demurrer, the Supreme Court of Appeals of West Virginia held that although the state constitution provided that no private property be taken or damaged for public use without compensation, the provision was not self-executing. Since the legislature had only provided for condemnation of real estate, no condemnation proceeding would lie for personalty. The court indicated in dicta that plaintiff's only remedy would lie in a tort suit against the contractor. (Heckerling-Florida)
W70-00342

WATERS AND WATERCOURSES - PUBLIC RIGHT OF FISHERY AS AN INCIDENT OF NAVIGATION.

Minn L Rev, Vol 40, p 88-91, 1955. 4 p, 18 ref.

Descriptors: *Missouri, *Navigable waters, *Ownership of beds, *Public benefits, Streambeds, Riparian rights, Non-navigable waters, Fishing, Relative rights, Eminent domain, Prescriptive rights, Competing uses, Easements, Public rights, Judicial decisions, Legal aspects.
Identifiers: *Public easements.

Navigability and its effect on rights to watercourses is discussed in relation to a recent Missouri case. In that case, plaintiff fisherman requested a declaratory judgement to determine his right to fish in a river navigable in fact by small craft but not navigable in fact by larger boats. The court held that the river was nonnavigable under the Missouri test, and thus the riparian owner had title to the bed of the stream; but since it was 'floatable', such title was subject to a public easement of travel and passage by floating and wading, which includes the right of fishery. After discussing federal and state tests of navigability, the comment explores the issue of whether fishing is rightfully an incident of navigation. The basic contention is that it is possible to reach the same result as the present case by another rationale--the trust theory that title to fish is in the state and thus the public should have a right to take them regardless of who owns the stream beds. Additional theories that are mentioned are dedication, prescription, estoppel, and eminent domain. (Schram-Florida)
W70-00345

FERRIES ON STREAMS WITHIN STATE.

Ind Ann Stat secs 36-2601 thru 36-2618 (1949).

Descriptors: *Indiana, *Transportation, *Boats, *Regulation, Administrative agencies, Legislation, Navigable rivers, Rivers, Streams, Creeks, Banks, Administration, Legal aspects.
Identifiers: *Ferries.

Any person owning land on any creek or river may, upon application to the appropriate board of commissioners and upon compliance with notice provisions, have a public ferry established across said river. A ferry may also be established across a river bounding two counties upon compliance with cer-

tain provisions. The board of county commissioners may establish a ferry where required if the owner of the land fails to have one established. Regulations concerning the number of boats and hands, and ferry man bonding and duty requirements are included, as are provisions for ferrying people without a license. The rates of ferriage are fixed by the board. Ferry landings may not be obstructed. Penalties for violation of the regulatory provisions are set forth. (Moulder-Florida)
W70-00352

TOWNSHIP LINE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00354

BRIDGES OVER CANALS.
For primary bibliographic entry see Field 04A.
W70-00355

POWER TO ACQUIRE CONTROL AND DISPOSE OF PROPERTY.

Ky Rev Stat Ann sec 88.090 (1963).

Descriptors: *Kentucky, *Cities, *Shores, *Real property, Legislation, Coastal structures, Administrative agencies, Leases, Rent, Public benefits, Control, Piers, Legal aspects.

The board of trustees of any sixth class city may purchase, lease, or receive real and personal property which may be necessary for municipal purposes. The board shall have control of such property for the benefit of the city. The board may also dispose of any such property to benefit the city. Waterfront property may not be sold or conveyed, but the board may rent waterfront property for a term not to exceed 20 years. Wharf privileges may be rented for up to 5 years. (Heckerling-Florida)
W70-00364

PUBLIC PARKS-WATERS-POWERS OF THE BOARD.
Ind Ann Stat sec 48-5728 (1963).

Descriptors: *Indiana, *Local governments, *Administrative agencies, *Parks, Maintenance, Rivers, Streams, Assessments, Legislation, Bank protection, Levees, Flow control, Pollution abatement, Water pollution control.

The Board of Park Commissioners shall have power to keep open and clean rivers, streams, and waterways, and they shall improve the banks of such waters, build levees, control water flow, and promulgate rules and regulations concerning any waters within or bounding on any public park. The Board is also empowered to require owners of real estate abutting such waters to remove objectionable pollutants upon five days notice. If such owners fail to comply, the Board may cause such objectionable material to be removed, and the county treasurer shall assess the cost to the property owner. (Darragh-Florida)
W70-00366

LEVEE CONSTRUCTION AND MAINTENANCE.
For primary bibliographic entry see Field 04A.
W70-00367

WATERSHED CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 04D.
W70-00368

FENCES ON OVERFLOWED LANDS.
Ind Ann Stat secs 30-501 thru 30-512 (1969).

Descriptors: *Indiana, *Land tenure, *Overland flow, *Overflow, Legislation, Cost sharing, Cost-benefit ratio, Administrative agencies, Streams, Lakes, Ponds, Marshes, Surveys, Assessments, Compensation, Damages.
Identifiers: *Fences, *Viewers.

The owners of land used for purposes of cultivation and situated upon or near any stream or watercourse, lake, pond, or marsh, and subject to overflow therefrom, may petition for permission to inclose such area under one general fence. Viewers shall be appointed to inspect the land to apportion the cost of the fence among the owners. Such viewers shall submit a report of their assessment to the county commissioners. Provisions are made for the collection of the assessments. The viewers may employ a surveyor if necessary. If rails from the fence are carried away by the overflow of high water, the owner may recover the rails from the property of another if he does so within 60 days. The county recorder shall keep a record of marks on the rails and plank-fencing. Anyone who has recorded his mark and has his rails removed by high water may recover his rails at any time of the year, provided that he pays all damage done to growing grain on the land from which such rails or plank-fencing are to be removed. (Heckerling-Florida)
W70-00369

FISH AND GAME (LICENSES).

Ind Ann Stat secs 11-1401 thru 11-1406 (1956), as amended, (Supp 1968).

Descriptors: *Indiana, *Permits, *Regulation, Legislation, Administration, Recreation, Water sports, State governments, Fish, Sport fishing, Trout.
Identifiers: *Penalties (Civil), Licenses.

Hunting, fishing, and trapping licenses are required in Indiana. Upon payment of the applicable license fee, a specified amount of which is retained by the issuing officer, the license is issued. Any resident owner of farmland and his family may hunt and fish on land belonging to that owner without a license. Distinctions are drawn between residents and non-residents with regard to licensing fees. (Moulder-Florida)
W70-00370

JOINT CONSTRUCTION OF WATER SUPPLY.
For primary bibliographic entry see Field 03D.
W70-00371

HAYWARD V NOEL (ACTION FOR TRESPASS TO RIPARIAN LAND).

225 So 2d 638-642 (Ct App La 1969).

Descriptors: *Riparian rights, *Louisiana, *Real property, *Damages, Legal aspects, Judicial decisions, Land, Land tenure, Mississippi River, Relative rights, Rivers, Riparian land.
Identifiers: *Batture land.

Plaintiff brought this action to recover damages from trespass to his land. Defendants claimed ownership of plaintiff's land by title and adverse possession. The disputed land was a strip of batture land lying between the Mississippi River and a public road. Plaintiff's title was based on a reservation in a previous conveyance; the court ruled that the reservation was valid, that plaintiff's title was superior, and that plaintiff was entitled to recover damages. The court stated that a conveyance of property along a river conveys the riparian rights appurtenant therto, therefore a reservation of land along a river reserves those riparian rights. (Darragh-Florida)
W70-00372

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00373

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00374

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00375

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00376

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00377

COMMERCIAL FISHING AND MUSSEL LICENSES.

Ind Ann Stat secs 11-1412 thru 11-1419 (1956), as amended, (Supp 1968).

Descriptors: *Indiana, *Permits, *Commercial fishing, *Regulation, Administration, Mussels, Fish, Fishing, Water sports, Recreation, Nets, Fishing gear, Mollusks, Marine animals, Lake Michigan, Legal aspects.
Identifiers: *Licenses.

Indiana requires licenses for commercial fishing. Regulations concerning resident and non-resident commercial fishing licenses and fees applicable to Lake Michigan are provided. Also included are regulations concerning license and fee requirements for persons fishing the Wabash River where it forms a common boundary between Indiana and Illinois as well as where it flows within Illinois. License provisions and fees for residents and non-residents who take mussels or mussel shells are also provided. (Moulder-Florida)
W70-00378

W R WRAPE STAVE CO V ARKANSAS STATE GAME AND FISH COMM'N (CONDEMNATION FOR CONSERVATION OF WILDLIFE).
For primary bibliographic entry see Field 06G.
W70-00379

OHIO VALLEY COMPACT.
For primary bibliographic entry see Field 06B.
W70-00380

STREAMS AND WATERS.
For primary bibliographic entry see Field 05G.
W70-00381

CITY OF MARYVILLE V CUSHMAN (RIGHT TO CHARGE FOR SEWAGE DISPOSAL).
For primary bibliographic entry see Field 05E.
W70-00382

ANGLING LAWS.

Iowa Code Ann secs 109.67, 109.70-109.86 (1949), as amended, (Supp 1969)

Descriptors: *Iowa, *Freshwater fish, *Fishing, *Fishing gear, Frogs, Fish, Sport fish, Fish conservation, Fish farming, Fish management, Fish stocking, Farm ponds, Commercial fishing, Baits, Nets, Minnows, Bait fishing, Mississippi River, Missouri River, Artificial watercourses, Legislation, Legal aspects, Regulation.
Identifiers: Throw lines, Trot lines, Fish limits

Open seasons, catch limits, possession limits, and minimum lengths or weights of various species of fish are set out in tables. Fish may be taken with hook, line and bait only, and limits are specified for number of lines and hooks per line. Limits are placed on the number, size, and areas of use of trot

and throw lines. Each trot line must be identified, must have one end visibly set from shore, and cannot be entirely across a waterbody. Unlawful methods of taking fish are listed. Except to provide breeding stock for farm ponds, the State Conservation Commission may not stock private waters unless such waters are open to the public for fishing. Lawful dimensions for minnow nets are provided. A license is required for taking minnows for commercial purposes. Minnows cannot be taken from trout streams, and the Commission may designate other areas as protected. Minnows cannot be taken outside the state for sale. The use of specified bait is prohibited. (Douberley-Florida)
W70-00383

POWER OR WATER COMPANIES FLOODING BURIAL GROUNDS.

SC Code Ann secs 70-171 thru 70-177 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Reservoirs, *Flooding, Legal aspects, Lakes, Ponds, Legislation, Private rights, Relative rights, Water law, Reservoir operation, Artificial watercourses.
Identifiers: *Cemetaries, *Burial grounds.

Any water-power or reservoir company proposing to create an artificial lake, pond, or reservoir encroaching upon any cemetery or burial ground shall publish notice and follow procedures outlined in this act for re-location or other disposition of bodies prior to flooding the burial ground. (Harris-Florida)
W70-00384

FISH AND GAME.

NH Rev Stat Ann sec 211:46-211:64 (1964), as amended, (Supp 1967).

Descriptors: *Fish, *Fishing, *New Hampshire, *Regulation, Fish reproduction, Fish conservation, Legislation, United States, Administrative agencies, Trawling, Nets, Fish management, Commercial fishing, Permits, Fisheries, Planning, Shellfish.

Seasons and limits may be established for the taking of certain varieties of fish. The use of seines, nets, or weirs is forbidden and trawling for codfish is outlawed. Only residents of the state who have a permit may take shellfish in designated areas. Marine species can be regulated and motor vehicles are prohibited from driving on clam flats. The Governor may appoint an advisory committee on shore fisheries, which will suggest plans for propagation and regulation of the taking of shellfish and shore fish to the Department of Game and Fish. The Director of the Department of Game and Fish shall cooperate with the United States Department of the Interior in carrying out congressional projects concerning fish and wildlife. (Darragh-Florida)
W70-00385

OIL AND GAS WELLS--DECLARATION OF POLICY.
For primary bibliographic entry see Field 05G.
W70-00386

ENGINEER FOR LEVEE AND DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00387

RAILWAY CROSSINGS NEAR MISSISSIPPI RIVER.
For primary bibliographic entry see Field 04A.
W70-00388

SOMERSET VILLA INC V CITY OF LEE'S SUMMIT (APPORTIONMENT OF FLOOD DAMAGES).
For primary bibliographic entry see Field 04A.
W70-00389

DRAINAGE DISTRICTS EMBRACING PART OR WHOLE OF CITY OR TOWN.
For primary bibliographic entry see Field 04A.
W70-00390

OHIO RIVER VALLEY WATER SANITATION COMPACT.
For primary bibliographic entry see Field 05G.
W70-00391

EROSION CONTROL AND IMPROVEMENT OF NAVIGABLE WATERS.
For primary bibliographic entry see Field 04D.
W70-00392

SENECA PORT DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00393

OIL, GAS, AND SALT WATER WELLS.
For primary bibliographic entry see Field 05G.
W70-00394

DRAINS AND LEVEES-CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00395

PLANS OF RECLAMATION.
For primary bibliographic entry see Field 04A.
W70-00396

NORTH SUBURBAN SANITARY SEWER DISTRICT V WATER POLLUTION CONTROL COMM'N (WATER POLLUTION CONTROL STANDARDS).
For primary bibliographic entry see Field 05G.
W70-00397

CONSTRUCTION OF LEVEES AND FLOOD CONTROL PROJECTS.
For primary bibliographic entry see Field 04A.
W70-00398

SANITATION DISTRICTS.
For primary bibliographic entry see Field 05G.
W70-00399

SANITATION DISTRICTS.
For primary bibliographic entry see Field 05G.
W70-00400

SANITATION DISTRICTS.
For primary bibliographic entry see Field 05G.
W70-00401

SANITATION DISTRICTS.
For primary bibliographic entry see Field 05G.
W70-00402

SOIL AND WATER CONSERVATION DISTRICTS LAW.
For primary bibliographic entry see Field 03D.
W70-00403

SOIL AND WATER CONSERVATION COMMISSION.
For primary bibliographic entry see Field 04A.
W70-00404

FLOOD PREVENTION.
For primary bibliographic entry see Field 04A
W70-00405

ACQUISITION OF STATE LANDS BY THE FEDERAL GOVERNMENT.
For primary bibliographic entry see Field 04A.
W70-00406

ARKANSAS FORESTRY COMMISSION.
For primary bibliographic entry see Field 04D
W70-00407

ORGANIZATION OF DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00408

SPORT FISHING.
Conn Gen Stats Ann secs 26-108 to 26-141 (1960), as amended, (Supp 1969).

Descriptors: *Delaware, *Sport fish, *Fish conservation, *Fish management, Legislation, Commercial fish, Fisheries, Fish hatcheries, Fishing, Fish barriers, Fish passages, Fish stocking, Regulation, Baits, Bait fishing, Reservoirs, Bodies of water, Administrative agencies, Poisons, Controlled drainage, Bridges, Seasonal, Legal aspects.
Identifiers: Fishing rights, Demarcation (Streams).

The State Board of Fisheries and Game determines dividing lines between inland waters and marine districts and lines dividing lakes from running streams. The Board regulates fishing and taking of bait in all inland waters and may issue regulations relating thereto that, among other things, establish seasons, size limits, legal taking methods, restricted areas, control boats, access areas, and trespass limits from the banks of waterbodies. Certain species of fish may not be sold commercially, and taking fish by means of explosives, drugs, and poisons is prohibited. Specific provisions cover limitations on specific fish species, use of certain waterbodies, and prohibited fishing methods, and penalties are provided for offenses, to include forfeiture of equipment. Regulations provide for stocking fish in public and private waters and for the use of these stocked areas. Bait species may not be taken for removal from the state, and restrictions are imposed on introduction of new bait species into the state. Provisions cover construction of fishways over dams and prohibition of commercial fishing near fishways. The Board also engages in fisheries management with power to operate necessary facilities. (Douberley-Florida)
W70-00409

SPORT FISHING.

Conn Gen Stats Ann secs 26-108 to 26-117 (1960), as amended, (Supp 1969).

Descriptors: *Delaware, *Sport fish, *Fish conservation, *Fish management, Legislation, Fish, Commercial fish, Freshwater fish, Fisheries, Fish hatcheries, Fishing, Regulation, Bodies of water, Permits, Administrative agencies, Watercourses (Legal), Legal aspects.
Identifiers: Demarcation (Streams).

Upon notice and hearing, the State Board of Fisheries and Game may determine lines in streams and bays dividing inland waters and marine districts. It also establishes demarcation lines dividing lakes or ponds from streams flowing in or out of them. The Board may regulate fishing and taking of bait in all inland waters, including regulations establishing seasons and special open hours, legal methods of taking fish, legal lenghts and limits, restricted fishing areas, permit requirements, and rules for use of power craft. It may also designate areas exclusively for women, children, or handicapped persons, provide for entrance and exit to waterbodies, establish trepass limits from banks, and prohibit trespassing, damage, swimming, picnicking, parking, and litter-

ing on property under control of the Board. Commercial use of certain species of fish is prohibited; otherwise this chapter does not apply to commercial fishing nor may its provisions interfere with the public water supply. Penalties for violations are provided, and each fish illegally taken is a separate offense. The Board engages in fisheries management and is authorized to spend federal funds for fish and pond improvement facilities. (Douberley-Florida)
W70-00410

SPORT FISHING.

Conn Gen Stats Ann secs 26-118 to 26-137 (1960), as amended, (Supp 1969).

Descriptors: *Delaware, *Sport fish, *Fish conservation, *Fish management, Legislation, Fish, Commercial fish, Freshwater fish, Fisheries, Fish hatcheries, Fishing, Fish barriers, Engineering structures, Dams, Fish passages, Fish ladders, Fish stocking, Regulation, Ice fishing, Farm ponds, Reservoirs, Bait fishing, Permits, Administrative agencies, Poisons, Toxins, Striped bass, Carp, Legal aspects.
Identifiers: Licensing.

Written permission must be obtained before fishing in reservoirs used for domestic water supplies. Use of explosives, drugs, and poisons for taking fish is prohibited. Specific limitations are placed on taking striped bass, on fishing in certain ponds, and through the ice. It is unlawful to take bait for transportation out of the state, except for hatcheries or private waterbodies, and permits must be obtained for introducing carp and goldfish into the state. The state may not stock areas in which the owner will not allow public fishing, except by sale of surplus stocks to the owner. If private waters are registered, the owner may take any fish without a license. Permission must be obtained before any stocking is done, and the Board of Fisheries and Game may regulate privately stocked waters upon request. Boats, tackle, and implements may be forfeited for violation of any of these rules and regulations. Obstructions to the passage of fish are prohibited except to prevent escape of stocked fish and to prevent fish from entering machinery flumes. Individuals may petition to have a fishway constructed on an artificial obstruction, and commercial fishing is prohibited near a dam or fishway. (Douberley-Florida)
W70-00411

SPORT FISHING.

Conn Gen Stats Ann secs 26-138 to 26-141 (1960), as amended, (Supp 1969).

Descriptors: *Delaware, *Fish conservation, *Fish management, *Drainage practices, Legislation, Fish, Commercial fish, Freshwater fish, Fishing, Regulation, Administrative agencies, Controlled drainage, Drainage effects, Bridges, Legal aspects.
Identifiers: *Fishing rights, Penalties (Criminal).

A waterbody may not be drained for the taking of fish. Any draining that might endanger fish life must be reported to the Director of the State Board of Fisheries and Game prior to draining. Fishing rights in streams crossing highways are in the abutting owner, condemnee, or grantor, unless fishing rights have been otherwise transferred and compensated for. The Highway Commissioner has full authority to regulate bridge fishing. Unless otherwise provided, maximum penalty for violating this act is $100 and 30 days imprisonment for each offense. (Douberley-Florida)
W70-00412

6G. Ecologic Impact of Water Development

ECOLOGICAL EFFECTS OF WEATHER MODIFICATION: A PROBLEM ANALYSIS.
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
Charles F. Cooper, and William C. Jolly.
University of Michigan, School of Natural Resources Report, May 1969. 160 p, 140 ref. 14-06-D-6576 (Bureau of Reclamation, Office of Atmospheric Water Resources).

Descriptors: *Weather modification, *Ecology, Wildlife, Aquatic habitats, Silver iodide, Insect invasion, Weeds, Plant diseases, Monitoring.

If deliberate modification of weather can be achieved, the structure of plant and animal communities may be altered through shifts in rates of reproduction, growth, and mortality of weather sensitive species. Weather modification may interact with other ecological stresses such as air pollution and pesticide application to produce changes greater than the sum of the individual effects. The argument is rejected that because the change anticipated from weather modification is smaller than the normal variability of weather, weather modification will have little or no biological effect. Catastrophic outbreaks of weeds or insect pests are unlikely as a result of weather modification, but not impossible. Big game animals could be adversely affected if snow accumulation is significantly increased on winter range. Somewhat different effects are anticipated in semiarid and in humid regions. There does not appear to be an immediate serious threat of environmental contamination from silver iodide or other seeding agents. If a global environmental monitoring system is developed, it should deal with all forms of environmental change, not weather modification alone. No research dealing specifically with ecological effects of weather modification has yet been reported. Institutional arrangements may have to be altered to obtain research support in this area. The report includes sections of anticipated kinds of weather modification; effects in semiarid climates and in humid climates; pests and diseases; direct effects of seeding agents; biology of lakes and streams; fog, hail, lightning, and hurricane modification; environmental monitoring programs; inferences from ecological theory; recommended research; and recommended pre-modification field surveys.
W70-00140

CHANGES IN LAKE WASHINGTON FOLLOWING AN INCREASE IN THE NUTRIENT INCOME,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W70-00270

THE WATER RESOURCE,
Department of the Interior, Washington, D.C.
Luna B. Leopold, and Seymour Tilson.
International Science and Technology, p 24-34, July 1966. 13 fig.

Descriptors: *Water resources, Water Pollution, Diseases, Sewage, Industries, Ethics, Water management (Applied), Precipitation (Atmospheric), Irrigation efficiency, Hydrologic cycle, Groundwater, Lakes, Ponds, Snow, Equilibrium, Dams, Water table, Wells, Aquifers, Arid lands, Grasslands, Forests, Permeability, Wetlands, Environmental engineering, Pollutants, Water purification, Bacteria, Biochemical oxygen demand, Eutrophication, Soil moisture, Statistical models, Electrical networks, Simulation analysis, Monitoring.
Identifiers: Cholera, Dysentery, Hepatitis, Typhoid, Esthetics, Quality, Indus River plain (West Pakistan), Impermeable surfaces, Hydrologic flow system, Degradable wastes, Ruhr Valley (Germany), Taft Sanitary Engineering Center, Hydrologic-ecologic foreknowledge, Round Lake (Fla), Arkansas River, Platte-Big Blue River, El Paso (Tex), Kentucky River, Non-degradable wastes.

Total water in rivers and ground is ample for future needs; regional shortages can be alleviated by some optimum combination of pollution control, water reprocessing and reuse, and groundwater development; water deficient regions can benefit by river diversion. However, whether pollution problems can be cured at this point is doubtful. Intervention of man in natural equilibria--physical, ecological, and hydrological--has created an entirely new hydrologic system which cannot reach its equilibrium while man continues to alter its parameters. The precise effects of these changes are not known because population requirements and varied wastes are so widespread that basic hydrologic data have become mere historical records. The lack of hydrologic data can result in critical problems as schemes, of continental proportions, for rerouting water from one drainage basin to another come under scrutiny. Water management studies are also seriously deficient since no method exists for assignment of meaningful numbers to esthetic and ethical uses. Stochastic models describing overall environmental behavior, electrical networks as analog models for groundwater systems, and simulation methods based on digital computer are trends in hydrology. The technical community should keep its ears attuned to river murmurs as well as to the whine of turbines. (Jones-Wisconsin)
W70-00272

BIOLOGY AND ECOLOGY OF NITROGEN.
California Univ., Davis.
For primary bibliographic entry see Field 02K.
W70-00277

PROBLEMS OF THE PROTECTION OF WATER IN CONNECTION WITH THE BUILDING OF WATER-POWER PLANTS (IN GERMAN),
For primary bibliographic entry see Field 05G.
W70-00292

THE LIMNOBIOCHEMISTRY OF DEVILS LAKE, NORTH DAKOTA,
North Dakota Univ., Grand Forks.
For primary bibliographic entry see Field 05C.
W70-00311

W R WRAPE STAVE CO V ARKANSAS STATE GAME AND FISH COMM'N (CONDEMNATION FOR CONSERVATION OF WILDLIFE).

219 SW2d 948-953 (Ark 1949).

Descriptors: *Arkansas, *Wildlife conservation, *Eminent domain, *Fish conservation, Remedies, State governments, Condemnation, Reservoirs, Dams, Pipelines, Easements, Conservation, Fish, Wildlife, Judicial decisions, Legal aspects, Administrative agencies, Compensation.

The State Game and Fish Commission sought to condemn lands for the creation of a reservoir for a fish and game reserve. Defendant landowners opposed the condemnation alleging that it was not authorized for the purposes contemplated by the legislature and that the land was already devoted to a public use in that defendant's pipeline served the public. The defendants appealed from an adverse ruling in the chancery court. The supreme court affirmed this decision. It found that the Arkansas constitution granted the Fish and Game Commission broad discretion in determining how wildlife should be conserved and that it had not been established that the Commission went beyond this. The court agreed that land which had been devoted to a public use could not be subjected to subsequent condemnation which would impair its first use. However, here the pipeline could have been reasonably maintained under the reservoir or relocated at a cost not incompatible with the Com-

mission's objectives. The inconvenience and cost to the pipeline company, while it required compensation, was not sufficient to justify injunctive relief. (Gabrielson-Florida)
W70-00379

07. RESOURCES DATA

7B. Data Acquisition

THE MEASUREMENT OF HIGH DISCHARGES IN TURBULENT RIVERS USING TRITIUM TRACER,
International Atomic Energy Agency, Vienna (Austria); and Ministry of Natural Resources, Nairobi (Kenya). Dept. of Water Development.
T. Florkowski, T. G. Davis, B. Wallander, and D. R. L. Prabhakar.
J Hydrol, Vol 8, No 3, p 249-264, July 1969. 16 p, 5 fig, 2 tab, 11 ref.

Descriptors: *Flow measurement, *Tracers, Turbulent flow, Stream gages, Gaging stations, Tracking techniques, Radioisotopes, Tritium, On-site tests.
Identifiers: Isotope dilution flow measurement.

Use of tritiated water as a tracer for measurement of flow rate in turbulent rivers offers a promising technique for high flows where other methods are not feasible. Examples of application are given from flow gaging in River Tana where flows from 100 to over 500 cu m/sec have been measured and compared with rating curves. Tritium technique proved to be accurate, easy to use in remote areas and applicable for high flow rates. (Knapp-USGS)
W70-00035

THIESSEN COEFFICIENTS BY A MONTE CARLO PROCEDURE,
Technion - Israel Inst. of Tech., Haifa. Hydraulic Lab.
M. H. Diskin.
J Hydrol, Vol 8, No 3, p 323-335, Jul 1969. 13 p, 5 fig, 2 tab, 2 ref, 1 append.

Descriptors: *Rainfall, *Runoff forecasting, *Probability, *Monte Carlo method, *Computer programs, Approximation method, Estimating, Rainfall disposition.
Identifiers: Thiessen polygon method.

A method of computation and a digital computer program for the determination of Thiessen weights of rainfall measuring stations is presented as a substitute to the graphical method commonly used for this purpose. The method is based on a Monte Carlo procedure for the estimation of the size of sub-areas of a rectangular area whereby the relative size of any sub-area is given by the limit as the number of points is increased of the ratio of random points falling inside the sub-area to the total number if such points generaged uniformly in the rectangular. An example of the use of the proposed method is also presented and the results obtained are discussed. (Knapp-USGS)
W70-00039

AN APPLICATION OF SURFACE GEOPHYSICAL TECHNIQUES TO THE STUDY OF WATERSHED HYDROLOGY,
Geological Survey, Helena, Mont.; and Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 02F.
W70-00209

SEDIMENT MEASUREMENT TECHNIQUES: A. FLUVIAL SEDIMENT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-00214

SEDIMENT MEASUREMENT TECHNIQUES: F. LABORATORY PROCEDURES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-00215

TRITIUM IN THE EQUATORIAL ATLANTIC CURRENT SYSTEM,
Miami Univ., Fla. Inst. of Marine Sciences.
For primary bibliographic entry see Field 02K.
W70-00224

THE FUTURE OF INSTRUMENTATION IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05A.
W70-00305

A RADIOGRAPHIC METHOD OF DETERMINING THE DIRECTION OF GROUND WATER FILTRATION IN DRILL HOLES,
Hydrogeological Enterprise, Warsaw (Poland).
Janusz Niemczynowicz, and Edward Fraczek.
Nukleonika, Vol 12, No 11, p 62-66, 1967. 5 p, 3 fig, 3 ref.

Descriptors: Groundwater, *Groundwater flow, *Groundwater movement, *Wells, Tracers, Radioisotopes, X-rays, *Boreholes, Water wells, *Drill holes, Filtration, Infiltration, Radiation measurement, *Radioactivity techniques, *Orientation, Direction finding.
Identifiers: Poland, Radiation detectors, *Radioactive tracers, Probes (Instruments), Foreign products, Gyro compasses, Radiography.

The radiometric single-hole method determines the direction of filtration in a drill hole by introducing a radioactive isotope into the water. The radioisotope is deposited by the flowing water on the filter and in the surrounding ground; absorption of the radioactive isotope is greatest in the direction of flow and least in the opposite direction. The center of greatest concentration is located with a directional radiation detector. The measuring instrument must be oriented to determine azimuths. A new probe has been developed for finding the direction of filtration. Radiation is detected on X-ray film; a gyroscopic direction indicator is used to orient the film. Using X-ray film has eliminated the need for intricate electronic equipment in the field. The gyroscopic direction indicator is suitable for measuring depths to 300 m. (USBR)
W70-00331

COLOR MIMICRY IN GEOLOGY AND GEOPHYSICS,
Geological Survey, Washington, D.C.
B. F. Grossling.
Geophys, Vol 34, No 2, p 249-254, Apr 1969. 6 p, 7 ref.

Descriptors: *Color, Data processing, Data reduction, Vision, Optical properties, *Optical instruments, Photographic equipment, *Photographs, Photography, Maps, *Aerial photography, *Geologic investigations, Geology, Geophysics.
Identifiers: *Data presentation, Optical analysis, Transparency, Optical measurements, *Photographic analysis, Visual aids.

Color mimicry is proposed as a method for revealing more information in a picture than is otherwise obtainable from an ordinary color or black and white photograph. The technique consists of preparing a color synthesis of 2 or 3 pictures of the same object or scene. Transparencies of the pictures are projected and superimposed on a screen, using a separate projector for each transparency. Various color effects are produced by using different combinations of white light and color filters in the projectors, adjusting the relative intensities of the projector lights, and deliberate misalinement of the projected images. The colors used in the mimicry need have nothing to do with any actual color sensation in the original data. The pictures may be taken from the visual or other bands of the electromagnetic spectrum, or even need not be photographs. Gray level representations of 2-dimensional fields of abstract data or data physically different than radiation can also be mimicked in color. (USBR)
W70-00332

THE DESIGN, CONSTRUCTION AND PERFORMANCE OF A VIBRATING-WIRE EARTH PRESSURE CELL,
H. S. H. Thomas, and W. H. Ward.
Bldg Res Sta Curr Pap, CP 14/69, May 1969. 15 p, 9 fig, 1 tab, 21 ref.

Descriptors: *Earth pressure, Effective stress, *Pressure gages, Earth dams, *Pressure measuring instruments, *Instrumentation, Soil mechanics, Calibrations, Foreign research, Hysteresis, Field tests, Bibliographies.
Identifiers: *Pressure cells, Arching, Arch action, Balderhead Dam (Gt Brit), Building Research Sta, DSIR, *Vibrating-wire strain gage.

Design and construction of a sturdy but accurate total earth pressure cell are described. Results from a group of cells buried in the clay core of an earthfill dam demonstrate the consistent performance and reliability of the cells over a 5-yr period. Modifying the cell permits a twofold use: measurement of soil pressure on a rigid surface and stress within a soil mass. The buried cell is 11 in. in diameter and 1-1/2 in. thick. The sensitive area on the cell face is 34% of the total area and the diameter/deflection ratio is slightly over 2000. When installed on a rigid surface, the cell is set in a ring of cold-setting rubber to prevent distortion by flexure of the structure. Models with maximum ranges of 100, 200, and 300 psi are being built. Vertical pressure readings during the last stages of construction of the dam are low compared to values obtained from an elastic solution. This is the result of the core arching between the shoulders. When the reservoir was filled, an increase in the ratio between the horizontal and the vertical effective stress and a rotation of the axes of principal stress were observed. (USBR)
W70-00337

7C. Evaluation, Processing and Publication

DETERMINATION OF THE OPTIMUM STORAGE CAPACITY OF RESERVOIRS AND THE ASSOCIATED PROBABILITIES,
Ministry of Irrigation and Power, New Delhi (India).
For primary bibliographic entry see Field 02E.
W70-00038

MATHEMATICAL SIMULATION OF A STREAM-AQUIFER SYSTEM,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02A.
W70-00054

THE MECHANICS OF SURFACE RUNOFF,
Florida Univ., Gainesville. Dept. of Bioenvironmental Engineering.
For primary bibliographic entry see Field 02E.
W70-00055

THE USE OF THE SHALLOW WATER EQUATIONS IN RUNOFF COMPUTATION,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering; and Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02A.
W70-00056

WATER RESOURCE OBSERVATORY CLIMATOLOGICAL DATA WATER YEAR 1968.
Wyoming Univ., Laramie.

Wyoming Water Resources Research Institute, Water Resources Series No. 14, June 1969. 367 p, 179 tab, 179 fig. OWRR Report A-999-WYO.

Descriptors: *Data processing, *Climatological data.

Temperature and relative humidity data that have been reduced from hygrothermograph charts and non-recording precipitation gages are presented in tabular form. Four readings per day at 0600, 1200, 1800 and 2400 hours and the maximum and minimum are presented. The mean, maximum, and minimum temperatures are also shown graphically. The reduced data are transferred to punch cards for computation and tabulating by the University of Wyoming's digital computer. The card format and computer program were presented in Wyo. WRRI Water Resources Series No. 8.
W70-00138

ANALOG-DIGITAL MODELS OF STREAM-AQUIFER SYSTEMS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W70-00204

AUTOMATIC BED DATA ABSTRACTING USING A HYDRAULIC SCALE MODEL (FRENCH),
Department of National Hydrology (France).
For primary bibliographic entry see Field 02J.
W70-00250

GENERATING SYNTHETIC STREAM-FLOW RECORDS FOR NEW ZEALAND RIVERS,
Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02E.
W70-00251

GENERATION OF MONTHLY STREAM-FLOW DATA,
Ministry of Works, Wellington (New Zealand). Civil Div.
For primary bibliographic entry see Field 02E.
W70-00255

MOISTURE AND ENERGY DISTRIBUTION WITHIN A SLOPING SOIL MASS DUE TO A FINITE DURATION STEADY RAINFALL,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 02G.
W70-00307

08. ENGINEERING WORKS

8A. Structures

CHARACTERISTIC PRESSURE DISTRIBUTION IN OUTLET WORKS INLETS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Robert G. Cox, and Yen-Hsi Chu.
Corps Eng Rep No H-69-8, Sept 1969. 31 p, 17 ref.

Descriptors: *Hydraulic models, *Outlet works, *Hydraulic design, Model studies, Water structure, Flow resistance, Laboratory tests, Flow rates, Flood control.
Identifiers: *Pressure distribution, Upstream face geometry.

This report summarizes a study of inlet pressures measured in nine hydraulic models and two laboratory investigations of entrance designs for flood control outlet works. The experimental data are examined to determine the effects of upstream face geometry, guide piers, and bulkhead and gate slots. Both two-dimensional and three-dimensional flow inlets are considered and compared with free-streamline inlets. The results are presented graphically in terms of dimensionless pressure drop coefficients for use in estimating pressure conditions to be expected in design practice. Design criteria are recommended. (Lang-USGS)
W70-00002

RESUME OF THE REPORT ON THE FAILURES,
Central Electricity Generating Board, London (England). Generation Design Dept.
I. W. Hannah.
Natural Draught Cooling Towers - Ferrybridge and After, Proceedings of the Conference held at the Institution of Civil Engineers (June 12, 1967) p 1-7, 1967. 5 fig, 2 tab, 7 ref.

Descriptors: *Cooling tower, *Design criteria, *Structural design, Thermal powerplants.
Identifiers: *Ferrybridge Power Station.

The final report is summarized which the Committee of Inquiry produced in August 1966. Abstracts from the report are used wherever possible and the paper concludes with the full recommendations of the Committee, since it is probable that much of the design and development work on cooling towers to be undertaken in the next few years, will be guided by these recommendations. The main criticisms were: (a) use of a 1 min maximum mean wind speed for the design loading; (b) reinforcement proportioned without sufficient margins to cover uncertainties in wind loading and their dynamic effects; (c) sensitivity of design to minor changes in pressure coefficient distribution was not appreciated. Specification and design of the towers were discussed along with meteorological conditions, mode of failure, and research investigations. (Ross-Vanderbilt)
W70-00143

STRUCTURAL DESIGN PHILOSOPHY,
University Coll., London (England). Dept. of Civil Engineering.
A. H. Chilver.
Natural Draught Cooling Towers - Ferrybridge and After, Proceedings of the Conference held at the Institution of Civil Engineers (June 12, 1967) p 9-13, 1967. 3 fig, 7 ref.

Descriptors: *Cooling tower, *Wind pressure, *Structural design, Elastic theory.
Identifiers: Wind loading, Critical dynamic pressure, Ferrybridge cooling tower.

An attempt is made to show the difficulties in formulating a structural design philosophy for hyperboloidal cooling towers. The problem is complicated by the fact that the actual state of wind loading of a cooling tower is unsteady and random in nature. The unsteadiness appears to be accentuated in groups of towers. It is suggested that an acceptably low rate of structural failures, of the order of one group of towers, within 20 similar groups, once in 25 years, implies the design of towers to collapse at wind speeds of about 125 miles/hr. This probably corresponds to an elastic design wind speed of about 100 miles/hr. Some special problems of the structural design of hyperboloidal cooling towers are considered briefly, including the importance of shell-bending effects, buckling under wind loading and resonant vibrations. Reinforced concrete towers may become prone to static or dynamic instability because of extensive vertical cracking; it is suggested that some form of circumferential prestressing may be necessary to overcome the weakening effects of vertical cracks. (Ross-Vanderbilt)
W70-00144

CONSEQUENTIAL PROBLEMS ON OTHER CEGB STATIONS,
Central Electricity Generating Board, London (England).
W. A. Fitzherbert.
Natural Draught Cooling Towers - Ferrybridge and After, Proceedings of the Conference held at the Institution of Civil Engineers (June 12, 1967), p 45-49, 1967. 3 fig, 1 tab.

Descriptors: *Cooling tower, *Design standards, *Structural design.
Identifiers: *Ferrybridge power station, *CEGB stations, Meridional reinforcement in the shell, Notional tensile strength, Pressure coefficient specifications.

The Ferrybridge Report concluded that the basic cause of collapse of the completed cooling towers was due to errors in specification and design rather than to faulty construction and pointed out that these faults may well have been introduced at other contemporary stations. Subsequent analysis has confirmed this and the paper discusses the practical problems of introducing adequate factors of safety in these existing structures. Preliminary investigations revealed a pronounced weakness in the provision of meridional reinforcement in the shell. The collapsed shells were to be rebuilt with 8 inch walls having a similar total amount of reinforcement to that used in the strengthened shells, divided between the faces to increase local bending stiffness. (Ross-Vanderbilt)
W70-00145

THE ROUND TURBULENT JET IN A CROSS WIND,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
J. F. Keffer, and W. D. Baines.
Journal of Fluid Mechanics, Vol 15, Part 4, p 481-496, Apr 1963. 13 fig, 12 ref.

Descriptors: *Winds, *Jets, *Model studies, Flow profiles, Turbulent flow.
Identifiers: *Entrainment, *Entrainment coefficient.

Model studies of the flow of a jet normal to a uniform, steady cross-wind were made in a low speed air tunnel. Velocity ratios (jet to ambient) were varied from 2 to 10. Experimental results show that for various jet strengths the position of the jet in space, when stretched by the ratio of jet to cross-wind momenta, is described by a single function. Exceptions exist at very low velocity ratios where a shift of the potential core is evident. A natural system of axes is used to define important directions of the flow. The integrated equation of motion along the primary jet flow direction is made dimensionless after the general method of Morton (1961) and a virtual source is defined by the flow. It is shown that a single functional behavior of the axial jet velocity ratios if the jet is considered to originate from this source. Lateral velocity profiles show a similarity when scaled by appropriate lengths and velocities but true self-preservation is not attained. (Guerrero-Vanderbilt)
W70-00154

HYPERBOLIC COOLING TOWERS,
Leslie (Robert) and Partners.
W. M. Stern.
Power, Vol 111, p 59-62, Feb 1967.

Descriptors: *Cooling towers, Structural design, Wind pressure.
Identifiers: *Hyperbolic cooling towers, *Economics of cooling towers, Exhaust effluent, Tower spacing, Wind-loading.

When constructing natural draft cooling towers, especially the immense hyperbolic towers, very severe structural requirements must be met. Layout of multiple towers, economics, climate and wind loading, height of exhaust, packing or fill arrangements to dimension the ultimate diameter of

the tower, or packless towers, spray equipment, availability of water and construction materials are all factors to be considered. Now commonly constructed are the hyperbolic concrete-shell cooling towers. Climbing scaffolds and slipforms are used in their construction. (Rietveld-Vanderbilt)
W70-00291

PHILOSOPHY OF FAILURE,
Imperial Coll. of Science and Technology, London (England). Dept. of Engineering.
A. L. L. Baker.
Natural Draught Cooling Towers - Ferrybridge and After, Proceedings of the Conference held at the Institution of Civil Engineers (June 12, 1967) p 15-17, 1967. 1 fig, 1 tab, 2 ref.

Descriptors: *Cooling towers, *Structural analysis, Concrete construction, Wind pressure.
Identifiers: *Ferrybridge cooling tower, Buckling resistance, Tower shells, Aerodynamic data.

The paper points to the large differences between the buckling resistance of cooling-tower shells and their ability to oppose uplift forces, and indicates the importance of increasing the latter. Preserving the shell structural stiffness by correct arrangement of the necessary additional reinforcement is also considered essential. From regarding the Ferrybridge collapse as a massive full-scale experiment, a design philosophy compatible with the European Concrete Committee limit state approach is outlined. The significance of the present lack of reliable aerodynamic data and the remarkable sensitivity of tower shells to variations in loading are clearly described. (Ross-Vanderbilt)
W70-00294

MATHEMATICAL ASPECTS,
National Physical Lab., Teddington (England).
E. L. Albasiny, and D. W. Martin.
Natural Draught Cooling Towers-Ferrybridge and After, proceedings of the conference held at the Institution of Civil Engineers (June 12, 1967), p 31-35, 1967. 6 fig, 3 ref.

Descriptors: *Cooling towers, *Mathematical studies, *Structural analysis, Wind pressure.
Identifiers: Bending solutions, Membrane solutions, Base distortion effects, Elastic equilibrium, Ferrybridge cooling tower.

Numerical solutions have been obtained to the complete linear equilibrium equations for a single hyperbolic cooling tower shell subjected to a steady wind loading. The Authors' published results for a typical tower show (a) that the bending solutions in the main body of the shell are unaffected by the additional support conditions assumed at the base; (b) that the bending and membrane solutions for the direct forces and displacements are in good agreement and (c) that maximum moment values occur near the throat of the tower, apart from possible edge effects, and vary roughly as the square of the shell thickness. The analysis is extended here by permitting tangential displacements at the base of the shell which are proportional to the net horizontal edge-force and to the vertical stress-resultant. It is demonstrated that the bending stresses can be substantially increased by these flexible support conditions, whereas the direct stress-resultants are relatively unaffected. It is further shown that the effect of a local subsidence at the base of the shell is to induce bending stresses. (Ross-Vanderbilt)
W70-00295

VIBRATION OF COOLING-TOWER SHELLS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
J. J. Williams.
Natural Draught Cooling Towers-Ferrybridge and After, proceedings of the conference held at the Institute of Civil Engineers (June 12, 1967), p 37-43, 1967. 14 fig, 11 ref.

Descriptors: *Cooling towers, *Wind pressure, *Model testing, *Vibrations.
Identifiers: Ferrybridge cooling towers, Hyperbolic cooling tower, Cone-toroid cooling tower, Dynamic stiffness, Natural frequencies.

Theoretical and experimental investigations of the frequency response of hyperbolic and cone-toroid cooling-tower shells have shown that the lowest natural frequencies are associated with a circumferential wave number of 4 or 5, and an axial wave number of 2 (in normal displacement). Comparison of the lowest natural frequencies of a cone-toroid and a corresponding hyperbolic shell shows that in general, the frequencies of the hyperboloid are significantly higher. This indicates that meridional curvature is a critical parameter governing the dynamic stiffness of cooling-tower shells. (Ross-Vanderbilt)
W70-00296

SOME AERODYNAMIC PROBLEMS OF GROUPED COOLING TOWERS,
Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
P. R. Owen.
Natural Draught Cooling Towers-Ferrybridge and After, proceedings of the conference held at the Institute of Civil Engineers (June 12, 1967) p 73-78, 1967. 4 fig, 2 tab, 7 ref.

Descriptors: *Cooling towers, *Wind pressure, Flow profiles.
Identifiers: Aerodynamic problems, Ferrybridge cooling tower, Wind shear.

Certain aerodynamic problems of grouped cooling towers are discussed: namely, the tendency of the group to slow-down the approaching wind and to ameliorate the so-called 'channelling effect'; and the possibility, revealed by experiment, of fluctuating forces being magnified in comparison with those on an isolated tower. Some remarks are made about the effect of wind shear on the pressure distribution over a tower and lead to the suggestion that, over the windward face of the tower, the distribution is comparable with that arising from a uniform wind whose velocity is approximately the same as that in the sheared wind at a distance from the ground equal to the height of the tower. (Ross-Vanderbilt)
W70-00298

REDUCED PUMP HEAD CROSSFLOW COOLING TOWERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 05D.
W70-00320

STATUS OF BIG COOLING TOWERS,
Marley Co.
E. P. Hansen, and J. J. Parker.
Power Engineering, Vol 71, No 6, p 38-41, May 1967. 3 fig.

Descriptors: *Cooling towers.
Identifiers: *Cross-flow design, Louvers, Towerfill, Drift eliminators, Pressure preservative treatment, Joint connectors.

The article discusses the design and advance material usage of cross-flow design. Problem of icing, entry of debris and deterioration of wood material of towers have been averted by the design and arrangement of today's cross-flow cooling towers. Louvers are constantly flooded with warm water preventing a build up of ice. Asbestos-cement board or reinforced fiberglass is used to eliminate deterioration problems. In design of towerfill, grids of stable, inert material, such as reinforced fiberglass are used to support full splash bars which prevent sagging, and permit fill to expand and contract without warping or cracking. A good design of drift eliminator will operate efficiently with a static pressure drop of less than 0.04 in. (of water) at an airflow rate of 500 fpm and will limit water loss by drift to less than 0.2% of the volume of water being circulated. Fan cylinder is made of glass-reinforced polyester panels, which, when assembled form an ideal eased air inlet and an outlet which provides recovery of discharge air velocity. Single units of hyperbolic natural-draft towers can handle cooling water requirements for units up to 1000 MW. The first hyperbolic unit went on line in 1962 and currently 18 are either completed or contracted for in the United States. (Upadhyaya-Vanderbilt)
W70-00321

A NEW METHOD OF DETECTING AND SEALING LEAKS IN WATER RESERVOIRS,
For primary bibliographic entry see Field 08E.
W70-00322

STEEL TUNNEL LINER PLATE ASSEMBLY, FABRICATION, TRANSPORTATION AND INSTALLATION IN THE ANGELES TUNNEL,
California State Dept. of Water Resources, Sacramento.
Leo H. Moir, Jr.
Tech Memo 41, Dep Water Resour, Calif, Jan 1969. 23 p, 18 fig, 2 tab.

Descriptors: *Tunnel linings, *Steel linings, Reinforcing, Stiffening, Fabrication, Handling equipment, Inspection, Transportation, Welding, Weight, Construction, Welded joints, X-ray inspection, Grinding, Installation, *Tunnel construction, Tunnels, California.
Identifiers: Tunnel supports, *California Aqueduct, Stiffeners.

The Angeles Tunnel on the west branch of the California Aqueduct requires reinforcement in places of faulting and minimum overburden. This reinforcement is provided by a circular steel tunnel liner 30 ft in diameter, fabricated underground from 30-ft-long sections known as Cans. Weight of these Cans, including the external stiffener ribs, varied from 53 to 116 tons, and required unusual engineering methods in fabrication, quality control, and placement. The location of the areas of tunnel reinforcement, specifications for the Cans, methods of assembly and fabrication, inspection procedures, transportation, and installation are described. Photographs of fabrication and installation are included. (USBR)
W70-00327

STRUCTURAL MODEL TESTS OF ARCH DAMS--GLEN CANYON AND MORROW POINT DAMS,
Bureau of Reclamation, Denver, Colo.
George C. Rouse, William Lockman, and James A. Stubbs.
Res Rep No 16, Bur Reclam, Denver, Colo, 1969. 30 p, 28 fig, 15 ref.

Descriptors: Structural analysis, *Arch dams, *Concrete dams, Analogs, *Model tests, Models, Deflection, Stress analysis, Bibliographies, Loads (Forces), Test procedures, *Structural models, Trial-load method, Safety factors, Dam design, Materials, Mechanical properties, Poisson ratio, Elasticity modulus, Plasters, Strain gages, Temperature.
Identifiers: Glen Canyon Dam, Morrow Point Dam (Colo), Test results.

Techniques used by the Bureau of Reclamation in making structural analyses of Glen Canyon and Morrow Point concrete arch dams by means of models are outlined. Included in the report are: (1) a short history of model testing for concrete dams, (2) preparation of model materials, (3) model construction techniques, (4) loading and testing methods, and (5) comparisons of model stresses and deflections with similar quantities computed by the trial-load method. Model testing techniques used by the Bureau of Reclamation are compared with those developed in Portugal at the Labora-

torio Nacional de Engenharia Civil (LNEC) and in Italy at the Instituto Sperimentale Modelli e Structure (ISMES). (USBR)
W70-00335

COUNTY LINE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00336

COMPOSITE ACTION BETWEEN BRICK PANEL WALLS AND THEIR SUPPORTING BEAMS,
City Univ., London (England).
P. Burhouse.
Inst Civ Eng Proc, Vol 43, p 175-194, June 1969. 20 p, 18 fig, 12 tab, 4 ref.

Descriptors: Structural design, *Structural behavior, *Bricks, Foreign research, Test procedures, *Beams (Structural), Loads (Forces), Stress, *Testing, Failures, Reinforced concrete, Deflection, Compression, Youngs modulus, Bending moments, Composite structures, Shear forces, *Walls, Compressive strength.
Identifiers: *Brick masonry, *Loading tests, *Destructive tests, Test results, Foreign testing, Great Britain.

Results are given of experimental work in which simply supported beams carrying brick walls were tested to failure, the load being applied at the top of the wall. The height-to-span ratio of the panel walls was varied and the supporting beams were either of reinforced concrete or cased structural steel joists. Experimental results are compared with results obtained from an analytical treatment of composite walls. Because of the concentration of stress that occurs in the masonry, permissible loads on walls acting in conjunction with their supporting beams should be less than loads specified in the British Standard Code of Practice (CP 111) giving the allowable working load on a brick wall. With a low height-to-span ratio of the wall, composite action may break down because of sliding at the wall-beam interface. (USBR)
W70-00339

THE SLIDING STABILITY OF DAMS,
Harald Link.
Water Power, Vol 21, No 3, 4, 5, p 99-103, 135-139, 172-179, Mar/Apr/May 1969. 18 p, 20 fig, 3 tab, 34 ref.

Descriptors: *Dams, *Shear resistance, *Shear tests, Foundation investigations, Dam design, Dam foundations, Rock mechanics, Deformation, Stability, Hydraulic structures, Core drilling, Concrete technology, Foreign design practices, Safety, Safety factors, Dam failure, Strain gages, Bibliographies, Gravity dams, Buttress dams.
Identifiers: *Sliding resistance, *In situ tests, Great Britain, Test results, Dam stability, Horizontal displacements.

Ensuring the permanent stability of a dam economically requires knowledge of all aspects of the natural characteristics of the underlying foundation area. Slide-proof construction is the foremost requirement, demanding precise knowledge of and sure judgment in subsoil conditions. Dam failures in the past stemmed all too often from lack of shearing or sliding resistance at the base. Review of international literature of the past 25 yr confirms a certain lack of precision in judging sliding stability, but worldwide gains in the knowledge of investigating site conditions in depth, using rock mechanics, have given much valuable experience in the past 10 yr. Present practices for various countries are discussed, with emphasis on shear resistance testing of rock masses at and below the base of a dam. The safety of existing dams can be monitored by careful study of deformation characteristics, recognizing early danger signals. Such measurements should be incorporated into the operational routine, at least during high-water periods. (USBR)
W70-00347

TOWNSHIP LINE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00354

BRIDGES OVER CANALS.
For primary bibliographic entry see Field 04A.
W70-00355

APPLICATION OF SHOTCRETE IN TUNNEL NO 1 AND TUNNEL NO 3,
California State Dept. of Water Resources, Sacramento.
Samuel S. Dulberg.
Tech Memo No 35, Dep Water Resour, Calif, Nov 1968. 30 p, 9 photo, 2 dwg.

Descriptors: Tunneling, *Tunnel linings, *Tunnel construction, Faults (Geology), Tunnels, *Gunite, Applizcation methods, Accelerators, Lagging, Concretes, Hardening, Rock bolts, Additives.
Identifiers: *Tunnel supports, Tehachapi-West Branch Proj, Calif.

Shotcrete is a modified, pneumatically applied mortar containing aggregates up to 3/4 in. in size and an accelerator that produces appreciable hardening within 15 min of application and structural strength within hours. Shotcrete was used as the primary support system for approximately 2400 linear ft of Tunnel No 1, and as supplementary support for approximately 900 linear ft of Tunnel No 3 of the Tehachapi-West Branch Project in California. This is the first time that shotcrete has been used as tunnel support in the State of California, and probably the first time in the United States. Shotcrete has been used successfully in Europe since 1957 for tunnel support in bad ground, with and without steel supports and rock bolts. Several problems experienced by the California contractor, including resistance from the miners because of unfamiliarity with this type of tunnel support, are discussed. The method is described and evaluated. Shotcreting can improve the art of tunneling by providing a less expensive and better support system. (USBR)
W70-00356

LEVEE CONSTRUCTION AND MAINTENANCE.
For primary bibliographic entry see Field 04A.
W70-00367

JOINT CONSTRUCTION OF WATER SUPPLY.
For primary bibliographic entry see Field 03D.
W70-00371

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00373

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00374

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00375

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00376

INTERSTATE BRIDGES.
For primary bibliographic entry see Field 04A.
W70-00377

FLOOD PREVENTION.
For primary bibliographic entry see Field 04A.
W70-00405

8B. Hydraulics

CHARACTERISTIC PRESSURE DISTRIBUTION IN OUTLET WORKS INLETS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08A.
W70-00002

A HYDRAULIC MODEL STUDY OF LANDSLIDE-GENERATED WATER WAVES IN BAYS,
California Univ., Berkeley. Hydraulic Engineering Lab.
Edward M. Kuba.
Shore and Beach, Vol 37, No 1, p 49-54, Apr 1969. 6 p, 6 fig, 11 ref.

Descriptors: *Waves (Water), *Landslides, *Model studies, *Hydraulic models, Seiches, Surges, Bays, Estuaries, Lakes, Reservoirs, Floods, Erosion.
Identifiers: Landslide-generated water waves.

A hydraulic model was constructed to study waves generated in bays, estuaries, and reservoirs by landslides. These waves may be hundreds of feet high and cause great loss of life and property, as at the Vaiont Dam, Italy, in 1963. The model is 1 ft wide, 3 ft deep, and 105 ft long. Waves are generated by sliding a block down an incline into the water at a measured speed. Wave height may be predicted when water depth, the horizontal landslide velocity component, and the horizontal component of landslide movement are known. (Knapp-USGS)
W70-00003

HYDROLOGY OF SMALL DRAINAGE BASINS FOR DEVELOPING HYDRAULIC DESIGN CRITERIA,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 02E.
W70-00137

EFFECTS OF WATER TEMPERATURE ON BED-LOAD MOVEMENT,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
John J. Franco.
Journal of the Waterways and Harbors Division, Proceedings of the American Society of Civil Engineers, Vol 94, p 343-352, Aug 1968. 8 fig, 1 tab, 5 ref.

Descriptors: *Sediment transport, *Water temperature, *Water flow, Stream bed, Bed load.
Identifiers: *Bed movement, Flume study.

Laboratory investigations have indicated that the effects of water temperature on the movement of sediment and on flow in alluvial streams can be appreciable. Some variations noted in flow conditions in the field can be attributed to the effects of water temperature. Information available on the subject has been confusing, or too general to permit the development of definite relations. An investigation undertaken to determine the effects of changes in water temperature on sediment transport, streambed forms, and bed roughness for various types of material is described. The effects of water temperature on bed-load appear to be mostly in the formation of the bed and the bed roughness. (Ross-Vanderbilt)
W70-00142

EFFECTS OF WATER TEMPERATURE ON THE DISCHARGE OF BED MATERIAL,
Department of the Interior, Washington, D.C.
B. R. Colby, and C. H. Scott.
Available from the Superintendent of Document, US Gov't. Printing Office, Washington, D.C., 20402, for $0.25 per copy. Geological Survey Professional Paper 462-G, 25 p, Washington, D.C., 1965. 18 fig, 1 tab, 27 ref.

Descriptors: *Water temperature, *Viscosity, Sediment transport, Alluvial channels, Suspended sediment, Fall velocity, Heated water.
Identifiers: *Temperature effects, Flume flows, Field streams, Laminar sublayer, Viscosity changes, Bed material discharge.

Changes in water temperature and consequent changes in viscosity affect bed-material discharge in complex ways. These ways may be explained in three separate effects. One effect is on the thickness of the laminar sublayer, and this effect is usually the smallest of the three. A second effect is on the vertical distribution of suspended bed material. The third effect is on the bed configuration and, hence, on the resistance to flow. Experimentally defined temperature effects on bed-material discharge usually require classification in terms of the flow characteristics that were kept constant, the variables that were involved in the analysis of the data, and the way in which the data was analyzed. Experimental defined temperature effects on the relation of bed-material discharge to mean velocity for three rivers indicate an average percentage increase of about 75 in bed-material discharge for a decrease of water temperature from 80 deg. to 40 deg. F. High concentrations of fine sediment increase the apparent viscosity of a water-sediment mixture. The addition of 20,000 parts per million of bentonite to distilled water has an effect on viscosity that is about the same as the effect on distilled water of a reduction in water temperature from 60 deg. to 34 deg. F. (Ross-Vanderbilt)
W70-00152

DISPERSIVITY TENSOR FOR TURBULENT UNIFORM CHANNEL FLOW,
Hydronautics, Inc., Laurel, Md.
Gedeon Dagan.
ASCE Proc, J Hydraul Div, Vol 95, No HY5, Pap 6794, p 1699-1712, Sept 1969. 14 p, 3 fig, 20 ref, append. OWRR Project C-1008.

Descriptors: *Dispersion, *Mathematical studies, Reynolds number, Mixing, Streamflow, Diffusivity, Diffusion, Silts, Turbulent flow, Thermal pollution, Waste dilution.
Identifiers: Dispersivity tensor.

The turbulent mixing of a solute in a streamflow is described with the aid of the dispersivity tensor. In a 2-dimensional pipe or wide channel flow only the radial, or vertical, dispersivity coefficient is significant and is usually determined through the Reynolds analogy. The analogy is extended to a 3-dimensional (i.e., channel of arbitrary section) uniform flow. It is shown that the mixing length theory leads to the representation of the dispersivity tensor in the terms of only 2 distinct coefficients: (1) A coefficient representing mixing normal to isovels which may be found through Reynolds analogy; and (2) a lateral dispersivity coefficient which has to be determined from dispersivity measurements. (Knapp-USGS)
W70-00210

NONDIMENSIONAL GRADUALLY-VARIED FLOW PROFILES,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-00216

INSTABILITY OF FLAT BED IN ALLUVIAL CHANNELS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
Harry M. Hill, Vajapeyan S. Srinivasan, and Tharakkal E. Unny, Jr.
Invest supported by research grant from Nat Res Council of Canada. ASCE Proc, J Hydraul Div, Vol 95, No HY5, Pap 6770, p 1545-1558, Sept 1969. 14 p, 5 fig, 3 tab, 25 ref, append.

Descriptors: *Open channel flow, *Alluvial channels, *Channel morphology, *Dunes, *Ripple marks, Bed load, Sediment transport, Hydraulics, Steady flow, Turbulent flow, Scour, Regime.
Identifiers: Alluvial channel stability.

The occurrence of different bed forms has been considered as an instability in the flat bed flow. A general functional relationship was developed for the instability of flat bed when it is replaced by either dunes or ripples. Two distinct relationships exist for the two instabilities. A region of transition exists in between the two functions where either instability may occur. The stability function is useful to predict the occurrence of different bed forms. (Knapp-USGS)
W70-00217

FLOOD WAVE MODIFICATION ALONG PRISMATIC CHANNELS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Giampaolo Di Silvio.
ASCE Proc, J Hydraul Div, Vol 95, No HY5, Pap 6777, p 1589-1614, Sept 1969. 26 p, 9 fig, 2 tab, 25 ref, 3 append.

Descriptors: *Floods, *Waves (Water), *Flood routing, Hydrographs, Flood forecasting, Mathematical models, Open channels, Open channel flow, Unsteady flow, Hydraulics.
Identifiers: Flood wave attenuation.

The general behavior of a flood wave propagating along a prismatic channel is examined. Attenuation is not always to be expected, and a criterion for discriminating attenuation and amplification of flood waves is stated, quite similar to the analogous criterion for infinitesimal perturbations. An approximate procedure for flood waves that are approximately fitted by a triangular shape is developed; a set of nondimensional graphs may be used to predict the modification with respect to time of a triangular wave in dependence of two parameters called 'attenuation' and 'distortion-coefficient.' A simple formula is suggested to calculate peak attenuation or amplification, which does not depend on the distortion coefficient. Comparisons with experimental tests seem to be quite satisfactory. Some auxiliary elements are given for facilitating computations in part-full circular pipes. (Knapp-USGS)
W70-00218

ONE-DIMENSIONAL ANALYSIS OF FLOODS AND TIDES IN OPEN CHANNELS,
Tippetts-Abbett-McCarthy-Stratton, New York.
For primary bibliographic entry see Field 02E.
W70-00226

DEVELOPMENT OF ROLL-WAVE TRAINS IN OPEN CHANNELS,
California Univ., Irvine. Dept. of Civil Engineering.
Richard R. Brock.
ASCE Proc, J Hydraul Div, Vol 95, No HY4, Pap 6704, p 1401-1427, July 1969. 27 p, 16 fig, 5 tab, 12 ref, 3 append.

Descriptors: *Open channel flow, *Unsteady flow, *Waves (Water), *Hydraulics, *Supercritical flow, Turbulent flow, Model studies, Hydraulic models, Open channels.
Identifiers: Roll waves.

The maximum depth at wave crest, minimum depth at wave trough, wave period and wave velocity of spontaneously developed roll-wave trains were measured in a laboratory channel. Channel slope was varied from 0.05 to 12, normal depth was varied by a factor of 2, and the Froude number of the undisturbed flow (F) ranged from 3.5 to 5.6. For each of the 4 properties, a single development curve resulted for all depths with slope and F fixed. The spatial rate of growth of the average maximum depth increased as F was increased by increasing slope. The growth rate decreased as slope was increased and F was held fixed. Substantial growth occurs when one wave overtakes and combines with another wave. Growth also occurs without wave overtaking. Spontaneously developed roll waves are shown to be related to periodic permanent roll waves. Methods of applying the laboratory results to other channels with inlet conditions similar to that of the laboratory channel are presented. (Knapp-USGS)
W70-00227

FLOW RETARDANCE IN VEGETATED CHANNELS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
Nicholas Kouwen, T. E. Unny, and Harry M. Hill.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR2, Pap 6633, p 329-342, June 1969. 14 p, 7 fig, 2 tab, 21 ref, append.

Descriptors: *Open channel flow, *Vegetation effects, *Roughness (Hydraulic), *Retardance, Streamflow, Model studies, Hydraulic models, Laboratory tests, Flow resistance, Fluid friction, Mannings equation, Roughness coefficient.
Identifiers: Flow retardance.

A quasi-theoretical analysis is given for the flow retardance in vegetated channels. Based on this, a logarithmic flow formula is derived for flow in these channels. The analysis is illustrated with flow data obtained from channels in which natural vegetation was present and from a laboratory flume having flexible artificial roughness elements fixed to the bottom. (Knapp-USGS)
W70-00228

SPREAD OF BUOYANT JETS AT THE FREE SURFACE,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil ENGINEERING.
James J. Sharp.
ASCE Proc, J Hydraul Div, Vol 95, No HY3, Pap 6538, p 811-825, May 1969. 15 p, 4 fig, 1 tab, 20 ref, append.

Descriptors: *Dispersion, *Jets, Open channel flow, Mixing, Model studies, Hydraulic models, Nozzles, Orifices, Stratified flow, Hydraulics, Waste dilution.
Identifiers: Jet spreading, Bouyant jets.

A study is made of the surface spread which occurs when a jet of fluid is discharged at depth into a fluid of greater density. The method of synthesis is used to relate the rate of spread to the conditions at the point where the jet plus entrained fluid flow reaches the free surface. It is explained how these conditions can be related to the initial conditions at the nozzle by means of dilution diagrams. Experiments are described, which confirm the correlation obtained and also provide the basis of a working diagram for rate of spread. The shape of the curves of this spread diagram are explained and it is shown how the curves can safely be extrapolated, in one direction, into the working prototype range. The spread diagram can be used as a means of predicting spread and as a design diagram for choosing scales for hydraulic models. The method for choosing scales is outlined by an illustrative example and the difficulties of incorporating a nozzle in the model to reproduce a prototype spread are emphasized. (Knapp-USGS)
W70-00232

RECOVERING THE KINETIC ENERGY OF A FALLING LIQUID IN A COOLING TOWER,
Central Electricity Generating Board, London (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 05D.
W70-00316

PROFILES OF THE ROUND TURBULENT JET IN A CROSS FLOW,
Toronto Univ. (Ontario).
Bruce D. Prette, and W. Douglas Baines.
Journal of the Hydraulics Division, ASCE, Vol 93, No HY6, Proc Paper SS56, p 53-64, Nov, 1967. 9 fig, 5 ref.

Descriptors: *Turbulence, *Jets, Turbulent flow, Models, Flow.

The shape of a jet issuing normal to a uniform cross wind has been studied experimentally for a large range of jet to wind velocity ratio, R, and over a large distance downstream of the source. A situation with only dynamic effects and a jet to wind velocity ratio more than one (R> 1) is studied. Photographs taken of an oil aerosol jet were used to determine the size and position of the jet; and mean velocity measurements were made close to the outlet. Dimensional analysis shows that for negligible viscous stresses the jet profile and cross section size are functions only of R. A momentum flux equation combined with experimental observation leads to a single form for the profile, with all linear dimensions divided by R. Experimental measurements also show that the shape follows the same parameter, and indicate zones of the jet in which the translational and vortex motions dominate. Consequences of the form of the results are discussed. (Guerrero-Vanderbilt)
W70-00318

HORIZONTAL TWO-DIMENSIONAL DENSITY CURRENT,
New South Wales Univ., Kensington (Australia).
I. R. Wood.
Journal of the Hydraulic Division, ASCE, Vol 93, No HY2, Proc Paper 5139, p 35-42, Mar, 1967. 5 fig, 2 ref.

Descriptors: *Density currents, *Flow, Hydraulic jump, Froude number.
Identifiers: *Entrainment.

The flow in the region of entrainment for a two dimensional horizontal density current was examined and was compared with that of the hydraulic jump. It has been shown that the depth of flow in the region where entrainment has dropped to negligible proportions is uniform and is dependent on the inflowing densimetric Froude number. The data are presented giving the upstream and downstream depths of flow and the shape of the region of entrainment as a function of the inlet densimetric Froude number. Conclusions were: (1) The similarity of entraining and free surface hydraulic jump; (2) The marked effect of the inflowing Froude number on the constant c, which relates inlet Froude number to downstream depth of the density current. (Guerrero-Vanderbilt)
W70-00319

8C. Hydraulic Machinery

SYNTHETIC TESTING USING CAPACITIVE CURRENT VOLTAGE SOURCES,
Sydney Univ. (Australia).
H. K. Messerle, and D. K. Sweeting.
Inst Eng, Aust, Elec Eng Trans, Vol EE4, No 2, p 179-188, Sept 1968. 10 p, 15 fig, 17 ref.

Descriptors: *Circuit breakers, *Test facilities, *Test procedures, Initial costs, Operating costs, Flexibility, Reliability, Costs, Electric currents, Electric potential, Electrical equipment, Foreign research, Capacitors, Bibliographies.
Identifiers: *Synthetic test methods, Testing equipment, Test results, Foreign testing, Australia, Cost savings, Waveforms.

For reasons of economy and flexibility, synthetic testing of circuit breakers having large breaking capacity is being introduced in place of conventional full-power testing methods. Principal features of synthetic testing of circuit breakers are discussed. Simple and inexpensive capacitive energy storage banks used to set up a synthetic test station for general purpose testing are described. Advantages of a synthetic testing station using capacitive power supplies for the current and voltage sources are given. Using capacitors not only simplifies operation of the test station and reduces operating costs, but also reduces initial cost compared to that for a more conventional test facility. This method simulates field conditions more closely and provides more flexibility than some other testing methods. (USBR)
W70-00326

SINGLE-PHASE BRIDGE CONVERTER WITH A NEW CONTROL AND A CORRESPONDING THREE-PHASE CONVERTER--I. OPERATIONAL FEATURES: II. METHODS OF CONTROL,
Bonneville Power Administration, Portland, Oreg; and General Electric Co, Schenectady, N.Y.
Narain G. Hingorani, and Philip Chadwick.
Direct Curr, Vol 1, No 1, p 25-35, Apr 1969. 11 p, 16 fig, 10 ref.

Descriptors: *Converters (Electrical), Direct current, Alternating current, Electrical design, Control, Foreign research, Electric potential, *Control systems, Electrical equipment, *Electric currents, Rectifiers, Inverters.
Identifiers: Great Britain, Harmonics, *Electric converter valves, Thyristors.

A fully-controlled, single-phase bridge circuit and a corresponding 3-phase version consisting of 3 single-phase bridge circuits in series are evaluated. Using the new control for the single-phase circuit, one valve pair connected to one of the d-c poles may be fired at a different angle of delay than the other valve pair. Angle of delay of one pair is changed until the limit is reached when the angle of delay of the other pair is changed for further control. This mode of operation provides substantial advantage over the converter with conventional control. Part I of the paper describes the operation of the single-phase bridge and the 3-phase series circuit using the new control and discusses various operational features. Part II presents a practical control scheme to obtain the desired control. (USBR)
W70-00346

LIGHTNING SURGES ON DC CABLES CONNECTED TO OVERHEAD LINES,
Royal Inst. of Tech., Stockholm (Sweden).
Sune Rusck
Direct Curr, Vol 1, No 1, p 41-44, Apr 1969. 4 p, 2 tab.

Descriptors: *Direct current, *Electric cables, *Lightning, *Surges, Electric insulation, Transmission lines, Attenuation, Damping, Time, Calculations, Reflection, Foreign research.
Identifiers: *Lightning surges, Overvoltage, Flashover, Traveling waves, Protection (Electrical), Spark gaps, Sweden.

Lightning surges to which an hvdc cable may be subjected when connected to overhead lines were investigated. Factors determining the magnitude of the voltage are the insulation level of the overhead line, the service voltage, the length of the line-end protection, the time to half-value of the lightning current and the cable attenuation; the magnitude of the lightning current has less influence. The largest surges are obtained on cables having a length less than 90 km at the end of the cable lying farthest away from the point of impact of the lightning stroke, and increase with decreasing cable length. If the cable is more than 30 km long and the basic insulation level of the overhead line is less than 4 times the service voltage, a line-end protection of a few km limits the surge to less than twice the service voltage. A sample calculation shows the effect of various parameters on the magnitude of surges. (USBR)
W70-00349

A STUDY ON DANCING OF OVERHEAD LINE BUNDLED CONDUCTORS,
Kansai Electric Power Co. Ltd., Osaka (Japan); AND Sumitomo Electric Industries Ltd., Osaka (Japan).
Yoshio Shichiri, Matsujiro Yamasaki, and Kazuhiko Okada.
Sumitomo Elec Tech Rev, No 12, p 10-16, Mar 1969. 7 p, 11 fig, 3 tab, 8 ref, append.

Descriptors: *Transmission lines, *Bundled conductors, Wind tunnels, Wind velocity, Test facilities, Test procedures, Drag, Lift, Winds, Vibrations, Foreign research, Wind pressure, Oscillation, *Conductors, *Electric cables.
Identifiers: *Galloping conductors, Test results, Japan, Testing equipment, *Aerodynamic forces.

The dancing (galloping) phenomenon of overhead line conductors caused by low-frequency, large-amplitude oscillations may result in electrical faults and mechanical damage to conductors. The occurrence is usually associated with the formation of ice on conductors, and is apt to increase with the increasing adoption of bundled conductors for overhead transmission lines. Wind tunnel tests were conducted on such aspects as: (1) comparison in aerodynamic force (drag and lift) characteristics between single and bundled conductors; and (2) effect of the twisting movement of bundled conductors on drag and lift force characteristics, particularly emphasizing an analysis of lift force characteristics, data for which have been scarce but closely connected with abnormal oscillation. Results of the wind tunnel tests on twin bundled conductors are described. (USBR)
W70-00359

SELECTION AND PERFORMANCE OF ANCHORS FOR GUYED TRANSMISSION TOWERS,
International Power and Engineering Consultants Ltd., Vancouver (British Columbia).
K. E. Robinson, and H. Taylor.
Can Geotech J Vol 6, No 2, p 119-137, May 1969. 19 p, 8 fig, 3 tab, 1 ref, disc.

Descriptors: *Anchors, *Anchored towers, Foreign construction, Foreign design practices, Transmission lines, *Transmission towers, Field tests, Backfill, *Guyed towers, Cast-in-place structures, Grouting, Economics, Soil investigations, Cost comparisons, Foundations.
Identifiers: Anchor plates, Anchor cables, Grillage rootings, Pull-out tests.

Designing anchors for guyed transmission line towers crossing difficult terrain involves construction considerations and theoretical soil mechanics. Two lines each over 540 mi long were built in British Columbia. Five anchors that were tested are: (1) buried plate with compacted backfill, (2) buried steel mat or grillage with loose backfill, (3) cast-in-place concrete with loose backfill, (4) power installed helical, and (5) grouted rod. The highly variable soil and access conditions along the line necessitated an anchor that could be installed economically in nearly all soil types and by ordinary construction equipment that could easily move between tower sites in rugged terrain. The simply installed, conservatively designed, cast-in-place concrete anchor satisfied these requirements at reasonable cost. Power-installed helical anchors and grouted rod anchors may provide an economical anchor in more uniform soil conditions where easier access exists, but require more detailed soil exploration and contract inspection than the cast-in-place concrete anchors. (USBR)
W70-00361

TECHNIQUES AND EQUIPMENT NEEDED FOR HVDC STUDIES,
Ebasco Services, Inc., New York.
A. W. Peabody.
Mater Prot, Vol 8, No 7, p 37-42, July, 1969. 6 p, 13 fig, 7 ref.

Descriptors: *Extra high voltage, *Direct current, Test procedures, *Corrosion, Transmission (Electrical), Corrosion control, Transmission lines, Instrumentation, Electric currents, Pipelines, Underground structure, Protective coatings, Electrical groundings, Electric potential.
Identifiers: *Stray current corrosion, *Ground currents, *Corrosion tests, *Ground return, Earth resistivity (Elect), Potential gradients.

High-voltage, Direct-current (hvdc) transmission systems are expected to be operational in the United States by early 1970. The unique stray current corrosion control problems associated with hvdc transmission involve testing techniques and instrumentation different from those in other types

of corrosion control testing. The importance of corrosion testing with respect to hvdc systems as well as procedures for determining potential gradient patterns and the location of maximum current discharge are discussed. Procedures used to measure current flow on structures are structure-to-earth potentials are described; measurement problems and instrumentation required are outlined. As hvdc systems become operational and experience is accumulated, a cooperative effort will be required to evaluate stray current effects on underground metallic structures and to develop measures of controlling the corrosive action of stray currents. (USBR)
W70-00365

8D. Soil Mechanics

THE DESIGN, CONSTRUCTION AND PERFORMANCE OF A VIBRATING-WIRE EARTH PRESSURE CELL,
For primary bibliographic entry see Field 07B.
W70-00337

EARTHWORK QUANTITIES BY RANDOM SAMPLING,
Construction Estimating, Inc.; and Gates-Scarpa and Associates, Inc., West Hartford, Conn.
Marvin Gates, and Amerigo Scarpa.
Proc Amer Soc Civ Eng, J Constr Div, Vol 95, No CO1, p 65-83, July 1969. 19 p, 4 fig, 4 tab, 1 ref, 2 append.

Descriptors: *Earthworks, Statistics, Construction, Estimating, Fills, Statistical analysis, *Sampling, Errors, Excavation, Embankments, Cuts, *Computation, *Calculations, *Measurement.
Identifiers: *Random sampling.

Statistical methods are applied to determine earthwork quantities. First, cut and fill areas are delineated and planimetered. Then a table of random numbers is used to locate sample items of depths of earthwork. The volume of earthwork is the product of the planimetered area and the weighted average of the sampled depths. The precision (error) of the answer is expressed as a function of confidence limit, average depth, contour interval, and number of sample items. The method is rapid, accurate, and yields the most meaningful results when compared with any other method used for computing earthwork quantities. The distribution of cut and fill areas can also be determined from the sample items used to find the depth of earthwork, a second source of error. Errors are quantified. (USBR)
W70-00341

FOUNDATION ANCHOR PILES IN CLAY-SHALES,
Prairie Farm Rehabilitation Administration (Saskatchewan).
J. L. Jaspar, and V. W. Shtenko.
Can Geotech J, Vol 6, No 2, p 159-175 May 1969. 17 p, 13 fig, 2 tab, 1 ref.

Descriptors: *Anchors, *Piles (Foundations), Pile spacing, Slabs, Clay shales, *Pile foundations, Shales, Spillways, Foundations, Field tests, *Expansive clays, *Expansive soils, Expansive forces, Swelling, Rebound, Foreign research, Foreign design practices, Differential displacements.
Identifiers: Pile tests, *Bearpaw shale, Swelling pressures, Canada, Belled anchors.

A test program was conducted at Gardiner Dam on the South Saskatchewan River Project, Canada, to obtain data on the design and performance of anchor piles installed in the Bearpaw shale formation. The formation is hard, is relatively undisturbed, contains joints or fissures in some places, has a water content less than 27%, and has a wet density greater than 120 pcf. The test area excavation was approximately 50 ft deep. Four test series were conducted, including quick loading by hydraulic jacks, long-term loading from swelling, and both of these types of loadings on piles with and without bells. The recommended design includes depth of anchoring, pile spacing, and size of anchor rod for various bell sizes. The design provides for some stretching without failure due to load applied through swelling of the shale. This will not eliminate swelling, but will reduce the rate and amount of swelling or differential movement. (USBR)
W70-00360

FOUNDATION FAILURES OF FOUR ROCKFILL SLOPES,
Council for Scientific and Industrial Research, Pretoria (South Africa).
Geoffrey E. Blight.
Proc ASCE, J Soil Mech Found Div, Vol 95, No SM3, p 743-767, May 1969. 25 p, 16 fig, 5 tab, 21 ref, append.

Descriptors: Clays, Fissures (Geology), Laboratory tests, *Rock fills, Overconsolidation, Shear tests, Shear, *Shear failures, Shear planes, *Shear strength, Vane shear tests, Slopes, Slope stability, *Foundation failure, Joints (Geology), Failures, Model tests, Waste dumps, Stability analysis, Soil mechanics, Quartzite, Bibliographies, Foundations.
Identifiers: In situ tests, Failure surfaces.

Failures of rockfill slopes were interpreted as large-scale shear tests on the foundation strata of stiff fissured clay. Analyses of the slope failures, together with in situ and laboratory shear tests on the clay, provided information on the relation between the strength in bulk of a stiff fissured clay and that measured by small-scale tests. Two failures were progressive and 2 were nonprogressive. For the nonprogressive failures and one progressive failure, strength in bulk was approximately equal to strength measured in small-scale field and laboratory tests. Strength in bulk found from the remaining progressive slide was less than strengths measured in small-scale tests. At all 4 sites in situ, effective horizontal stresses in the clay strata were about equal to the passive pressure resistance of the clay. This fact was used to provide an alternative assessment of bulk strength of the clay. (USBR)
W70-00363

8E. Rock Mechanics and Geology

ROCK VOLUME AND PORE VOLUME DATA FOR PLAINS REGION OF WESTERN CANADA SEDIMENTARY BASIN BETWEEN LATITUDES 49 AND 60 DEG N,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 02F.
W70-00248

STUDY OF GROUND WATER FLOW IN JOINTED ROCKS AND ITS EFFECTS ON THE STABILITY OF SOLID ROCKS (FRENCH),
Technische Hochschule, Karlsruhe (West Germany).
For primary bibliographic entry see Field 02F.
W70-00249

A NEW METHOD OF DETECTING AND SEALING LEAKS IN WATER RESERVOIRS,
Pierre Patin.
Transl from Fr, Bur Reclam Transl 814, July 1969. 44 p, 17 fig, disc. Ann Inst Tech Batiment Trav Publics, Vol 22, No 253, p 1-20, Jan 1969.

Descriptors: *Reservoir leakage, *Reservoirs, Lakes, Karst, Lightweight aggregates, *Sealants, Permeability, Density, Materials, Fibers, *Settling velocity, *Leakage, Filters, Seals (Stoppers), Suspended solids, Plastics, Seepage, Bituminous materials, *Reservoir surveys, Foreign research, Reservoir operation, Groundwater flow.
Identifiers: Sealing layers, Foreign testing, France, Greece, Asphalt emulsions, Lake Yliki (Greece), Lightweight concretes

Leaks in reservoirs may be detected by placing a specially constructed long-bristle mop in the water and observing the orientation of the bristles. Another method is to systematically dispense colored bristles into the water and record movement of the fiber by aerial photography or underwater divers. The method for sealing leaks consists of selecting various-sized solid materials having a density approximately equal to water, suspending them in water, and relying on water current flowing through the leak to deposit them. A natural barrier is built up by successively depositing fiber-size materials. The required density of the materials, settling velocity, and preparation of suitable materials for large- and small-size particles are discussed. Materials for large-size particles include pumice and cellular concrete. Density is controlled by coating the particles with asphalt emulsion. A mixture of plastic fibers is used as smaller-sized material. Final sealing is accomplished by depositing rubber emulsion or bituminous filaments. Field studies are described for detecting and sealing leaks at Lake Yliki in Greece. (USBR)
W70-00322

PERMEABILITY DISTRIBUTION IN ARCH DAM FOUNDATIONS AS A FUNCTION OF THE STRESS FIELD,
Pierre Londe, and Francis Sabarly.
Comptes-rendus, Premier Congres Soc Int Mec Roches, Lisbonne, Vol 2, p 517-521, 1966. 21 Transl from Fr, Bur Reclam Transl 815, July 1969. 13 p, 7 fig, 1 tab.

Descriptors: *Permeability, *Rock mechanics, *Rocks, Laboratory tests, *Rock foundations, Arch dams, Fissures (Geology), Grouting, Percolation, Drainage, Drains, *Compression, Stress, Watertight, Engineering geology, *Dam foundations.
Identifiers: In situ rock, In situ tests, Rock pressures, Permeability coefficients, Permeability tests, Compression tests, Radial diffusion.

Laboratory tests show that the permeability of small specimens of fissured rock varies with the compressive stress applied. This property can be extended to the scale of rock masses. Simplified computations, borne out by in situ tests, establish that fissures in most rock masses are very narrow, and that their width and the permeability of the mass are very responsive to variations in compressive stress. These findings point to the probability of a watertight barrier being formed in the foundation rock in the direction of the forces exerted by an arch dam, and to the consequences of this factor on the design of the grouting and drainage systems. Reducing the amount of grouting should be possible, which for the most part is not only expensive but useless. Systematizing drainage should be possible also, making it a fundamental and economical element in the stability of foundations. (USBR)
W70-00323

FOUNDATION TESTING FOR AUBURN DAM,
Bureau of Reclamation, Denver, Colo.
George B. Wallace, Edward J. Slebir, and Fred A. Anderson.
Pap, 11th Symp Rock Mech, Univ Calif, Berkeley, June 1969. 86 p, 31 fig, 2 tab, 12 ref.

Descriptors: Arch dams, Concrete dams, *Rock properties, Schists, *Dam foundations, Field investigations, *Foundation rocks, Foundations, *Foundation investigations, Stress relieving, Foundation bearing tests, Rock mechanics, Abutments, Discontinuities, Field tests, Shear tests, Engineering geology.
Identifiers: Rock competency, Auburn Dam (Calif), *In situ tests, Radial jacking tests, Sliding tests, Plate bearing tests, *Rock testing.

Auburn Dam will be a thin, double-curvature concrete arch dam 685 ft high with a crest length of 4000 ft. The foundation rock consists of a steeply inclined sequence of foliated metamorphic rock, chiefly amphibolite with minor talc and chlorite schists and serpentine. Both abutments and the channel section contain faults, shear zones, and joints. Geologic mapping of the various rock types and discontinuities, along with design considerations, is providing a basis for the foundation testing program. The program includes uniaxial and radial jacking tests to obtain load vs time deformation relationships, shear and block sliding tests for cohesion and friction factors, plate bearing test to evaluate compressibility of fault gouge, and stress relief tests to determine stress magnitude and direction in the rock mass. Test methods are described and field testing is discussed. Laboratory tests of NX core are performed concurrently to determine physical and petrographic properties. (USBR)
W70-00324

COLOR MIMICRY IN GEOLOGY AND GEOPHYSICS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W70-00332

THE RIGHT APPROACH TO EARTHQUAKE PREDICTION,
B. A. Petrushevskiy.
Phys Solid Earth, No 10, p 648-652, Oct 1968. 5 p, 5 ref.

Descriptors: *Earthquakes, Hazards, *Seismology, Geophysics, Economic impact, Seismic investigations, Geologic investigations, Psychological aspects, Population, Social aspects, Social impact, Safety, Urban areas, Warning systems, Foreign research, *Forecasting.
Identifiers: Earthquake focus, *Earthquake forecasting, Earthquake zones, Epicenters, USSR.

The possibility of accurately predicting the time of an earthquake is an unusually attractive prospect. Given advanced warning, persons living in cities could leave for places of safety. Damages would be limited to the destruction of empty buildings; thousands of lives would be saved. Looking at the practical aspects, earthquake prediction is very different from this idyllic situation. Prediction of occurrence-time apparently has priority over the prediction of when, how violently, and how frequently earthquakes may be expected. The scientific validity of earthquake-time prediction is very low and the effects of very unreliable earthquake-time prediction have yet to be considered. The lack of precision could cause serious mental trauma to populations waiting for an earthquake to strike, and the disruption of normal daily life would have far-reaching economic consequences to industry and Government. Earthquake-time prediction should not be neglected, but should be given an appropriate part in a thoroughly thought out and widely based multiple-prediction program. Determination of place and force of an approaching earthquake has developed from a theoretical study to a practical job, and should be given top priority in earthquake prediction for years to come. (USBR)
W70-00333

THE SLIDING STABILITY OF DAMS,
For primary bibliographic entry see Field 08A.
W70-00347

FAILURE OF FRACTURED ROCK,
National Mechanical Engineering Research Inst., Pretoria (South Africa).
Z. T. Bieniawski, H. G. Denkhaus, and U. W. Vogler.
Int J Rock Mech Mining Sci, Vol 6, No 3, p 323-341, May 1969. 23 p, 17 fig, 1 tab, 11 ref, 2 append.

Descriptors: *Rock mechanics, Rock properties, Quartzite, *Compressive strength, *Failure (Mechanics), Fractures, Rock excavation, *Rupturing, Stress, *Stess-strain curves, Strain, Testing machines, Sandstones, Test procedures, *Triaxial compression, Underground structures, Unconfined compression, Fractures (Geology).
Identifiers: Rockbursts, Rock tests, Foreign testing, Underground openings, Confining pressure, South Africa, *Multiaxial tests.

The most effective way of studying failure of fractured rock is by determining the complete stress-strain characteristics of the rock. Experimental techniques and multiaxial compression testing procedures are prescribed for determining the complete stress-strain curves for hard and soft rock. Special equipment was designed for this purpose. Test results are given on soft sandstone, hard quartzite, and hard norite. Modes of failure are reviewed. The strength and deformation characteristics of fractured rock are discussed and the significance of the test results is outlined. (USBR)
W70-00350

DETERMINATION OF THE COMPRESSIVE STRENGTH OF ROCK IN SITU OR IN TEST BLOCKS USING A DIAMOND DRILL,
National Technical Univ., Athens (Greece).
C. E. Tsoutrelis.
Ink, J Rock Mech Mining Sci, Vol 6, No 3, p 311-321 May 1969. 12 p, 6 fig, 3 tab, 12 ref, append.

Descriptors: *Rock mechanics, Rocks, Rock properties, Test procedures, *Drill holes, *Drilling, *Boreholes, Penetration, *Compressive strength, Unconfined compression, Engineering geology, Laboratory tests, Field tests.
Identifiers: *Rock tests, *Diamond drilling, Drillability index, Foreign testing, Greece, In situ tests, In situ rock.

A method has been developed for determining the compressive strength of rock in situ or in test blocks. Two equations are derived from experimental data to relate uniaxial compressive strength to diamond drill penetration rate. The validity of the method has been tested in the laboratory and in situ on several rocks ranging in compressive strength from 500 to 1300 kp/sq cm. Results are in good agreement with the Bureau of Mines standard procedure for compressive strength. The method (1) avoids the difficulties of specimen preparation, (2) is not affected by invisible cracks or discontinuities in the rock, (3) shows that compressive strength determination becomes more representative for the rock mass as drilling distance increases, and (4) is particularly useful for underground operations where a diamond drill is generally available. (USBR)
W70-00357

8F. Concrete

PHILOSOPHY OF FAILURE,
Imperial Coll. of Science and Technology, London (England). Dept. of Engineering.
For primary bibliographic entry see Field 08A.
W70-00294

SHEAR STRENGTH OF REINFORCED CONCRETE BEAMS,
Swedish Geotechnical Inst., Stockholm.
Bengt B. Broms.
Proc Amer Soc Civ Eng, J Struct Div, Vol 95, No ST6, p 1339-1358, June 1969. 20 p, 12 fig, 1 tab, 19 ref, append.

Descriptors: *Shear strength, *Reinforced concrete, Girders, Rotation, *Beams (Structural), Cracks, Structural engineering, Flexural strength, Reinforcement, Stress distribution, Laboratory tests, Strain, Failure (Mechanics), Stress concentration, Compression, Bibliographies, Shear.
Identifiers: *Diagonal tension, Stirrups, Ultimate strength.

Stress distribution at failure and failure modes of reinforced concrete beams with and without web reinforcement failing by shear-compression have been investigated. Behavior of these members is unaffected by the presence of the web reinforcement until one or several inclined cracks have formed within the shear span. The fact that diagonal tension cracks initiate at or close to existing flexural cracks indicates that the secondary stresses caused by the flexural cracks affect the diagonal tension cracking load. Stress redistribution taking place at the diagonal tension cracking load is caused by internal local rotation, increasing the width of the diagonal tension cracks. The crack width is proportional to the distance from the center of rotation at the apex of the diagonal tension crack. The ultimate strength of beams failing by shear-compression is dependent on the location of the diagonal tension crack within the compression zone, and the shear span ratio. The diagonal tension crack is located at the center of the compression zone. (USBR)
W70-00328

REVETMENT CONSTRUCTION BY FABRIFORM PROCESS,
Intrusion-Prepakt Inc., Cleveland, Ohio.
Bruce A. Lamberton.
Proc Amer Soc Civ Eng, J Constr Div, Vol 95, No CO1, p 49-54, July 1969. 6 p, 5 fig.

Descriptors: Construction, Construction materials, Textiles, *Concrete construction, Concrete structures, Columns, Embankments, Nylon, *Erosion control, *Formwork (Construction), *Revetments, Mortar, Bank protection, Slope protection.
Identifiers: Construction methods, *Facings, Fabrics, *Fabriform method, *Concrete linings.

The Fabriform process employs a high-strength, water-permeable, synthetic fabric as a concrete forming material. The water-cement ratio is reduced by forcing vehicle water through the fabric, causing substantial increase in strength and very rapid stiffening. Proper fabric design is essential to avoiding mortar loss. Applied to construction of erosion-control revetments, dual-wall fabric is placed on the surface to be protected and filled with mortar. The 2 layers of fabric may be woven together at regular intervals to form filter points providing relief from hydrostatic uplift. A uniform cross section is also available, containing internal fiber reinforcing. Fabriform is a reliable method for placing revetments of predictable dimensions above and below water, and may be applied to columns and thin-shell structures.
W70-00334

INVESTIGATION OF CONCRETE PROTECTIVE SEALANTS AND CURING COMPOUNDS,
Pennsylvania Dept. of Highways.
P. D. Stewart, and R. K. Shaffer.
Highw Res Rec, No 268, p 1-16, 1969. 16 p, 4 fig, 13 tab, 1 ref.

Descriptors: Concretes, Concrete technology, Concrete testing, Curing, *Curing compounds, *Protective coatings, *Sealants, *Surface sealing, Laboratory tests, Freeze-thaw tests, Penetration, Bituminous materials, Bonding.
Identifiers: Surface treatment, Bond, Bond strength, Bond tests.

Thirty-two products used as concrete protective sealants and curing compounds were evaluated in a 4-phase testing program. In the first phase, the ability of penetrating-type sealants to protect concrete against the deteriorating action of freeze-thaw cycles was evaluated. Concrete specimens measuring 1 ft square were coated with various product applications, filled with a chloride solution (5%), and subjected to 100 cycles of freeze-thaw. Surface scaling was measured at intervals using a numerical value system. During the second phase, 10 products recommended as combination curing-sealing compounds were tested. The curing properties were determined by comparing compression strengths of product-cured and moist room-cured

cylinders. Slab specimens cured with each product were subjected to freeze-thaw tests. In the third phase, a test method was designed to measure depth of sealant penetration into the surface of a typical concrete slab. A fluorescent material was mixed with several products before application; penetration was measured by linear traverse equipment using ultraviolet light. The fourth phase was devoted to equipment design and methods for determining the effect of sealants on bond between concrete and bituminous overlays. (USBR)
W70-00338

THE EVALUATION OF CONCRETE BY OUTDOOR EXPOSURE,
Hydro-Electric Power Commission of Ontario, Toronto.
V. R. Sturrup, and T. G. Clendenning.
Highw Res Rec, No 268, p 48-61, 1969. 14 p, 18 fig, 3 ref.

Descriptors: Concretes, *Concrete technology, *Concrete testing, Fly ash, Freeze-thaw tests, *Field tests, Laboratory tests, Durability, Air entrainment, *Concrete additives, Aggregates, Scaling, Cracking, Water-cement ratio.
Identifiers: Deleterious materials, Entrainment, Concrete properties.

Studies on outdoor performance of concrete have included variations in the water-cement ratio, the paste composition, and the aggregate quality. Parallel tests were performed in laboratory freeze-thaw apparatus by the rapid water-freeze cycle. Results indicate that when only one variable is changed, the accelerated freeze-thaw and the outdoor exposure tests place similar concretes in the same relative order of durability. A difference was noted in the breakdown in outdoor exposure between that caused by nondurable paste and that caused by nondurable aggregates. Progressive scaling below the waterline is associated with breakdown in the paste, while progressive popping and cracking is associated with unsound aggregates. Entrained air will not protect a nondurable coarse aggregate but under certain conditions may delay deterioration. While the benefits of entrained air are evident in both tests, accelerated freeze-thaw overemphasizes its performance compared with nonair-entrained concrete. On the outdoor exposure tests, benefits of entrained air are most pronounced at high water-cement ratios. (USBR)
W70-00340

MECHANISMS OF FROST ACTION IN CONCRETE AGGREGATES,
Pennsylvania State Univ., University Park.
P. D. Cady.
J Mater, Vol 4, No 2, p 294-311, June, 1969. 18 p, 6 fig, 6 tab, 7 ref.

Descriptors: *Aggregates, *Concrete technology, Adsorption, Concretes, Differential thermal analysis, *Frost action, Durability, Freeze-thaw, Tests, Test procedures, Instrumentation, Concrete testing, Expansion, Coarse aggregates, Petrographic investigations.
Identifiers: *Adsorbed water theory, Dilation, Concrete properties, Hydraulic pressure theory, Volume change.

The hydraulic pressure theory proposed by Powers and the adsorbed water theory recently advanced by Dunn and Hudec to describe the destructive mechanisms of frost action on concrete aggregates were investigated. The theories were in direct opposition regarding the state of water during the period when coarse aggregate underwent destructive volume change. Nine aggregate fractions of known and widely varying durability were tested for adsorption. Differential thermal analyses were performed on concrete specimens containing test fractions to determine the degree of freezability of the evaporable water content. Expansion (dilations) of test specimens were also obtained during the DTA runs. Multiple correlation analyses of test variables and examination of changes in heat evolution and specimen length during cooling revealed that Powers' hydraulic pressure mechanism was the major contributor to destructive volume change. However, the existence of the mechanism proposed by Dunn and Hudec was consistently in evidence. The latter mechanism was a minor contributor to the destructive volume change, but was the major effect for one of the test aggregates. At least 2 basic mechanisms were involved in frost destruction of concrete aggregates. (USBR)
W70-00362

8G. Materials

QUANTITATIVE ANALYSIS FOR CORROSION STUDIES BY THE MOSSBAUER EFFECT,
Princeton Univ., N.J. Dept. of Chemical Engineering.
Donald D. Joye, and Robert C. Axtman.
Anal Chem, Vol 40, No 6, p 876-878, May 1968. 3 p, 1 fig, 1 tab, 8 ref.

Descriptors: *Corrosion, *Chemical analysis, Chemical reactions, Rusting, Water chemistry, Well casings, Radiochemical analysis.
Identifiers: Mossbauer Effect.

The development of quantitative methods that utilize the Mossbauer Effect has lagged because of experimental difficulties. The corrosion of thin samples of iron, however, is a nearly ideal system for nondestructive, quantitative assay by a Mossbauer method. A constant acceleration spectrometer gave the ratio of the amount of unreacted iron to that of corrosion product formed in an atmosphere of water, Hydrochloric acid, and air. The spectrometer furnished an internal calibration for the method while a simple gravimetric technique provided an absolute calibration. Qualitative interpretation of the Mossbauer spectra aided in identification of the corrosion product. At room temperature the ratio of the Mossbauer efficiency of iron to that of the corrosion product is 1.61. (Knapp-USGS)
W70-00046

OPERATIONS RESEARCH AND THE MEASUREMENT OF MATERIALS,
Carborundum Co., Niagara Falls, N.Y.
Charles A. Bicking.
Mater Res Stand, Vol 9, No 6, p 8-13, 76, June 1969. 7 p, 8 fig, 5 ref.

Descriptors: Materials, Information retrieval, *Materials control, Materials engineering, *Materials testing, *Mathematical models, Digital computers, Mathematics, *Operations research, Experimental data, Quality control, Simulation, Specifications, Automatic control, Decision making, Instrumentation, Measuring instruments, PERT.
Identifiers: Materials information, Experimental design, Analog-to-digital converter.

Opportunities for direct coupling of materials science and operations research are described. In research and development, attention is directed to materials characterization, design, and analysis of experiments, and the selection and control of projects. In materials manufacture, areas of mutual activity include: (1) measurement and control of materials; (2) specification and acceptance or certification, including the design implications of materials; and (3) allocation of materials. Also discussed is the impact of computers in an age when requirements placed on materials are severe. In the future, simulation of applications will be the primary avenue of development new materials. (USBR)
W70-00325

LABORATORY INVESTIGATION OF AGING CHARACTERISTICS OF ASPHALT CEMENTS USED IN MEMBRANE LINING CONSTRUCTION,
Bureau of Reclamation, Denver, Colo.
W. R. Morrison.
Bur Reclam Lab Rep (ChE-91), Chem Eng Br, June, 1969. 40 p, 6 fig, 15 tab, 7 photo, 8 ref.

Descriptors: Laboratory tests, Asphalt, *Asphalt cement, Penetration, *Bituminous materials, Buried membranes, *Canal linings, Ductility, Data processing, Field tests, *Impervious linings, Materials testing, *Aging (Physical), Impervious membranes, Laboratory equipment, Weathering, Computer programming, Computers, Hardening.
Identifiers: Catalytically blown asphalt, Softening point, Product evaluation.

Laboratory test results indicate that the 14-day, 140 deg F oven aging test and the thin film oven test (ASTM D-1754) are satisfactory for determining the aging characteristics of asphalt cements used in membrane lining construction. Hardening is indicated by a decrease in penetration and ductility and an increase in softening point. These changes were reflected in the aging indexes. The 14-day aging test produced greater asphalt hardening. An aging index of 63.4 was obtained for asphalt cements subjected to the 14-day aging test, compared to an aging index of 73.7 for samples of the same asphalt cements subjected to the thin film oven test. New asphalt cements, by definition, have an aging index of 100. Comparing laboratory aging with field aging indicated that the 14-day, 140 deg F oven aging test produced asphalt hardening similar to that obtained at 14 yr field exposure. The thin film oven test produced asphalt hardening equivalent to 7 yr field aging. Based upon this investigation and other studies, asphalt cements now specified for Bureau of Reclamation membrane construction will provide satisfactory service for at least 14 yr. (USBR)
W70-00330

REVETMENT CONSTRUCTION BY FABRIFORM PROCESS,
Intrusion-Prepakt Inc., Cleveland, Ohio.
For primary bibliographic entry see Field 08F.
W70-00334

COMPOSITE ACTION BETWEEN BRICK PANEL WALLS AND THEIR SUPPORTING BEAMS,
City Univ., London (England).
For primary bibliographic entry see Field 08A.
W70-00339

SYSTEMS APPROACH TO ORGANIC COATINGS,
Du Pont de Nemours (E.I.) and Co., Philadelphia, Pa.; and PPG Industries, Inc., Springdale, Pa.
T. R. Matthews, M. M. Coburn, and L. R. LeBras.
Metal Progr, Vol 95, No 6, p 67-74, June, 1969. 8 p, 3 fig, 3 tab.

Descriptors: *Painting, *Paints, Primers (Painting), Curing, Finishes, Organic compounds, *Protective coatings, Varnishes, Lacquers, *Coatings, Films, Application methods, Enamels, Durability, Materials engineering, Costs.
Identifiers: Product evaluation, Plastic coatings.

Factors involved in selecting and applying an effective and economical coating system are discussed in a series of 3 articles. Organic coatings differ from conventional paints and from each other in composition, application method, curing, and performance characteristics. Many product finishes are special systems formulated for a single user, but are of general availability. Selection of the correct coating is discussed and relative durability, advantages, and limitations are summarized. Several application methods are reviewed. Solvent evaporation, oxidation, and polymerization methods for curing organic coatings are reviewed, as well as a short summary on electron-beam curing. The selected coating must be compatible with the application and curing methods, and capable of achieving the desired performance. Primers and topcoats must form a strong adhesive bond and are preferred for procurement from the same manufacturer. A systems approach is required for evaluat-

ing and selecting an organic coating for a given application. (USBR)
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8I. Fisheries Engineering

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FISH AND WILDLIFE RESOURCES.
For primary bibliographic entry see Field 03E.
W70-00199

FISH AND GAME (FISHING REGULATIONS).
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SPORT FISHING.
For primary bibliographic entry see Field 06E.
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For primary bibliographic entry see Field 06E.
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For primary bibliographic entry see Field 06E.
W70-00411

SPORT FISHING.
For primary bibliographic entry see Field 06E.
W70-00412

10. SCIENTIFIC AND TECHNICAL INFORMATION

A SELECTED ANNOTATED BIBLIOGRAPHY ON THE ANALYSIS OF WATER RESOURCE SYSTEMS,
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
Marshall Gysi, and Daniel P. Loucks.
New York Water Resources and Marine Sciences Center, Publication No 25, Aug, 1969. 177 p, 500 ref, 8 index charts. OWRR Proj W-111. Available from the Clearinghouse as PB 186 335, $3.00 in paper copy, and $0.65 in microfiche.

Descriptors: *Bibliographies, *System analysis, *Water resources, Optimization, Simulation analysis, Operations research, Abstracts.

Presented is an annotated bibliography of some selected publications pertaining to the application of systems analysis techniques to water-resource problems. The majority of the references included in this bibliography have been published within the last five years, mainly in Selected Water Resources Abstracts. About half of the entries have informative abstracts and keywords following the citation. Index charts give quick keyword access for all the references, the abstracted documents being completely keyworded, and the others title keyworded. The emphasis of the subject material abstracted is on optimization and simulation techniques that have been applied to water-resource problems.
W70-00306

STUDIES ON THE BLOOD MORPHOLOGY OF THREE ESTUARINE CYPRINODONTIFORM FISHES,
Federal Water Pollution Control Administration, West Kingston, R.I.
For primary bibliographic entry see Field 05C.
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Cornell University - Policy Models for Water Resources Systems	W70-00306	1
B. Others:		
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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 3, NUMBER 2
JANUARY 15, 1970

W70-00418 -- W70-00835

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 2
JANUARY 15, 1970

W70-00418 -- W70-00835

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

LAWS OF DISPERSION,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.
Richard L. Peskin.
Water Resources Research Institute Report, Rutgers University, New Brunswick, N.J. Oct 20, 1969. 46 p.

Descriptors: *Dispersion, Energy transfer, Turbulence, Mixing, Suspension, Bubbles, Water properties.

Two problems on the laws of dispersion for materials such as small particles and gas bubbles in turbulent streams are considered. After discussing the mechanisms of single-particle dispersion, a statistical approximation model is used to calculate two-particle dispersion. Specifically, the Eulerian fluid velocity which appears in the equation of motion of a small particle is replaced by a random best estimate. This estimate is obtained by prediction techniques using specified statistical properties of the turbulence field. The second problem considered is that of gas bubble dispersion. An approximate analysis is used to estimate the spread of bubbles from a line source of bubbles. Buoyancy and turbulence inhomogeneity effects, which result in a bubble size segregation, are evaluated.
W70-00732

PATTERNS OF THE THERMAL REGIME OF THE SURFACE LAYER OF WATER,
For primary bibliographic entry see Field 02D.
W70-00741

02. WATER CYCLE

2A. General

GENERALIZATION OF STREAMFLOW CHARACTERISTICS FROM DRAINAGE BASIN CHARACTERISTICS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-00440

HYDROGRAPH STUDY AND PEAK DISCHARGE DETERMINATION OF HAWAIIAN SMALL WATERSHEDS: ISLAND OF OAHU,
Hawaii Univ., Honolulu.
I-Pai Wu.
Hawaii Univ, Honolulu, Water Resources Res Center Tech Rep No 30, Mar 1969. 85 p, 9 fig, 2 tab, 11 ref, 3 append. OWRR Proj No B-003-HI.

Descriptors: *Rainfall-runoff relationships, *Hydrograph analysis, *Recession curves, *Small watersheds, *Hawaii, Infiltration, Unit hydrographs, Topography, Statistical methods, Regression analysis.
Identifiers: *Oahu.

Hawaiian small watersheds are unique in watershed hydrology because of the high infiltration rate, small size, and mountainous topography. The flood hydrograph, which has a short time to peak and small recession constant, can be expressed as a steep triangular shape. A peak discharge equation is derived from the concept of a triangular hydrograph and a linear storage of recession flow. The peak discharge equation can be shown as a very simple linear form, a function of time to peak and the surface runoff in inches. A linearity test between peak discharge and runoff has been made for Hawaiian small watersheds and a good linear relationship was found between peak discharge and surface runoff which is less than 6 inches not only for an individual small watershed but for watersheds of similar size. (Knapp-USGS)
W70-00449

SURFACE-WATER RESOURCES OF THE YOBE RIVER SYSTEM, NORTHERN NIGERIA, 1963-68,
Geological Survey, Washington, D.C.
B. E. Colson.
Geol Surv Open-file Rep, Jan 1969. 201 p, 6 fig.

Descriptors: *River systems, *Data collections, *Water utilization, *Hydrologic budget, Tributaries, Forecasting, Evaluation, Surveys, Water quality, Hydrogeology, Erosion control, Organizations, Gaging stations, Surface-groundwater relationships, Flow rates, Sediments.
Identifiers: *Nigeria, Yobe River system, Lake Chad.

This report describes the general hydrologic features of the Yobe River system, Nigeria, and presents hydrologic data on gage heights, daily discharge, and chemical quality and sediment content data for water samples at 18 stations in the system. Records for one site begin in 1958, but most records are for the 1963-1968 period. The Yobe (Komadugu) is tributary to Lake Chad and drains a 33,000 sq mi area in semiarid northern Nigeria. Less than 10% of the total surface runoff from the Yobe River system reaches Lake Chad, owing to evapotranspiration losses and to a much less extent by infiltration to groundwater storage. In the upper Yobe basin geologic controls limit groundwater development to shallow wells of low yield in many places and water supplies are obtained mostly from surface sources. The tributary Kano and Jemari Rivers have excellent quality water of low sediment load, but the Challowa River has a high sediment load. An estimated 15%, or more, of the rainy season runoff could be stored and would meet anticipated demands. (Lang-USGS)
W70-00456

SURFACE WATER AND RELATED CLIMATE FEATURES OF THE SAHIL SUSAH AREA, TUNISIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-00471

EVAPOTRANSPIRATION CLIMATONOMY: 1. A NEW APPROACH TO NUMERICAL PREDICTION OF MONTHLY EVAPOTRANSPIRATION, RUNOFF, AND SOIL MOISTURE STORAGE,
Wisconsin Univ., Madison. Dept. of Meteorology.
For primary bibliographic entry see Field 02D.
W70-00654

THE USE OF EXPONENTIAL FUNCTIONS WHEN CONSTRUCTING THE LAWS OF THE DISTRIBUTION OF GEOGRAPHICAL AND HYDROMETEOROLOGICAL PARAMETERS (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Meteorology; and Moscow State Univ. (USSR). Dept. of Climatology.
A. A. Dmitriev, and L. P. Uporova.
Russian text with English summary. Vestnik Moskov Univ, Ser 5, Geogr, No 4, p 100-105, July-Aug 1969. 6 p, 2 fig, 2 ref.

Descriptors: *Mathematical studies, *Hydrologic data, *Meteorological data, *Parametric hydrology, Probability, Statistical methods, Dispersion, Frequency analysis.
Identifiers: Exponential functions.

The use of a normalized orthogonal and exponential function for the study of the distribution of hydrometeorological and geographical parameters was investigated assuming certain types of distribution of parametric data. The study describes the possibility of the construction of some skew frequency curves by using a system of these orthogonal functions. Curves of some typical distribution laws are given and an approximate method for the evaluation of unknown parameters is presented. (Gabriel-USGS)
W70-00657

WATER BUDGET STUDIES IN KARST AQUIFERS,
McMaster Univ., Hamilton (Ontario). Dept. of Geography; and Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02F.
W70-00676

PHYSICAL INFLUENCES ON FLOW SERIAL CORRELATION,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-00723

2B. Precipitation

LAND USE ALONG A TROPICAL CLIMATIC BOUNDARY: THE WALAWE GANGA BASIN OF CEYLON,
National Academy of Sciences-National Research Council, Washington, D.C.
For primary bibliographic entry see Field 03B.
W70-00463

SOME METEOROLOGICAL REQUIREMENTS IN WATERSHED ENGINEERING RESEARCH,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 07A.
W70-00474

A CLIMATOLOGICAL BIBLIOGRAPHY OF THE SOUTH ATLANTIC OCEAN AREA, INCLUDING CERTAIN COASTAL COUNTRIES,
Environmental Technical Applications Center (Air Force) Washington, D.C.
For primary bibliographic entry see Field 10.
W70-00481

AN ANNOTATED CLIMATOLOGICAL BIBLIOGRAPHY OF ROMANIA,
Environmental Technical Applications Center (Air Force), Washington, D.C.
For primary bibliographic entry see Field 10.
W70-00482

RADAR-COMPUTED RAINFALL COMPARED WITH OBSERVATIONS FROM A DENSE NETWORK OF RAIN GAUGES,
Environmental Technical Applications Center (Air Force), Washington, D.C.
For primary bibliographic entry see Field 07A.
W70-00483

TRACTIONABILITY STUDY FOR THE LAOTIAN PANHANDLE,
Environmental Technical Applications Center (Air Force), Washington, D.C.
For primary bibliographic entry see Field 02G.
W70-00484

EARTHFLOW OCCURRENCE DURING HIGH INTENSITY RAINFALL IN EASTERN OTAGO (NEW ZEALAND),
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
M. J. Crozier.
Eng Geol, Vol 3, No 4, p 325-344, Oct 1969. 10 p, 5 fig, 1 tab, 11 ref.

Descriptors: *Landslides, *Rainfall, *Erosion, Pore pressure, Soil water movement, Infiltration, Percolation, Seepage, Mass wasting, Rockslides.
Identifiers: *New Zealand, Otago.

The characteristics and effects of an unusually heavy rainstorm causing landsliding in eastern Otago, New Zealand are discussed. The storm produced up to 8 inches of rain in 48 hr during a month, which, over the last 20 yr, has had a mean of 2.03 inches. These weather conditions triggered numerous landslides in an area which is believed to have become progressively unstable over the last 100 yr. A theory for the progressive development of unstable land in the locality is outlined. It centers around the change of soil properties induced by a removal of the indigenous forest. The relevant morphological and geological characteristics of a typical earthflow are listed and an account is given of the observed processes of earthflow occurrence. (Knapp-USGS)
W70-00647

HYDROLOGICAL REQUIREMENTS FOR WEATHER RADAR DATA,
A. F. Flanders.
World Meteorol Organ/Int Hydrol Decade Proj Rep No 9, 1969. 16 p, 1 tab, 16 ref.

Descriptors: *Radar, *Precipitation (Atmospheric), *Precipitation gages, *Instrumentation, Network design, Precipitation intensity, Surveys, Research and development, Rainfall, Snowfall, Meteorology.
Identifiers: Radar precipitation gaging, Meteorological radar.

Direct quantitative measurement of the average precipitation depth over drainage units would be a valuable tool in hydrological forecasting. Precipitation measurement by means of ground-based weather radar is being investigated in a number of countries. This report gives a brief survey of hydrological requirements for weather radar data based on experience in the U.S.A. with the Weather Bureau's radar network, and traces the application made of radar data to hydrological forecast problems encountered by the U.S. Weather Bureau. (Knapp-USGS)
W70-00673

AGRICULTURAL METEOROLOGY IN ISRAEL,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 03F.
W70-00691

POSSIBILITIES OF MAJOR CLIMATIC MODIFICATION AND THEIR IMPLICATIONS: NORTHWEST INDIA, A CASE FOR STUDY,
Wisconsin Univ., Madison.
Reid A. Bryson, and David A. Baerreis.
American Meterological Society, Bulletin, Vol 48, No 3, p 136-142, March 1967. 3 fig, 20 ref.

Descriptors: *Weather modification, *Deserts, *Dust storms, *Precipitation (Atmospheric), Arid lands, Climatology, Meteorology, Vegetation effects, Vegetation establishment, Monsoons, Economic impact, Social aspects.
Identifiers: *India, *West Pakistan, *Rajputana Desert, *Rajasthan Desert, *Subsidence (Atmospheric), Archaeology, Intermittent occupation.

Field observations and theoretical studies indicate that dense dust over northwest India and West Pakistan is a substantial factor in development of subsidence over the Rajasthan Desert. In the absence of this dust, there would be less radiation divergence in mid-tropósphere and thus, less subsidence and a deeper monsoon layer, with rains extending farther into the present desert area. Archaeological evidence suggests a long pattern of intermittent occupation with man playing an important part in making the desert. If man could establish a stablizing grass cover, there would be little blowing dust and the average subsidence would be reduced by perhaps one-third. This might result in more instability and increased showers during the day and increased dew formation on the grass at night. Social and economic consequences are outlined briefly. (Crouse-Arizona)
W70-00702

A CLIMATOLOGICAL EVALUATION OF PRECIPITATION PATTERNS,
Public Health Service, Washington, D.C.
For primary bibliographic entry see Field 04C.
W70-00740

2C. Snow, Ice, and Frost

THE EXCHANGE OF HYDROGEN ISOTOPES BETWEEN ICE AND WATER IN TEMPERATURE GLACIERS,
Iceland Univ., Reykjavik. Science Inst.
For primary bibliographic entry see Field 02K.
W70-00439

THREE-DIMENSIONAL SURGES AND RECOVERIES IN A NUMERICAL GLACIER MODEL,
Geological Survey, Tacoma, Wash.
William J. Campbell, and Lowell A. Rasmussen.
Canadian J Earth Sci, Vol 6, No 4, Part 2, p 979-986, Aug 1969. 8 p, 7 fig.

Descriptors: *Glaciers, *Surges, *Mathematical models, Regimen, Cryology, Rheology, Ice, Mountains, Frequency, Precipitation (Atmospheric), Slopes, Flow, Climates, Friction, Heat flow.
Identifiers: Glacier surges, Surging glaciers, Navier-Stokes equation.

To calculate glacier surges, the Navier-Stokes equation, integrated vertically to yield a 2-dimensional transport equation, is combined with the 3-dimensional continuity equation. By assuming a linear relation between volume transport and bottom shear stress, a system of numerically tractable differential equations is developed that contains a nonlinear surface slope term and a term in which horizontal frictional forces are stated explicitly. These equations, which are not based on perturbation analysis, are integrated directly on a high speed digital computer. The coefficient of each term in the flow equations is composed of physical parameters (gravity, density, viscosity); therefore, since no quantities such as ice velocities enter the equations, it is only necessary to specify an arbitrary bed configuration and a net-balance versus altitude curve to obtain a glacier solution. For 2 beds, valley and cirque, steady-state glacier solutions are found for a variety of bed and lateral frictional values. By reducing the bed friction coefficient for one year over the entire bed of the glacier, surges are induced in each of these cases. A reduction in bed friction to 5% of its original value yields a surge resembling typical observed surges. Interesting wave forms occur during the recovery. During the initial recovery, after the bed friction has been restored to its original value, height falls continue to occur even in the lower accumulation zone. The original steady-state shape is approached asymptotically, with total recovery taking hundreds of years. (Knapp-USGS)
W70-00443

SNOWY RANGE WATER RESOURCE OBSERVATORY (A Progress Report).
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 07C.
W70-00480

THERMAL STRATIFICATION IN THE ARCTIC OCEAN,
Oregon State Univ., Corvallis; and Naval Postgraduate School, Monterey, Calif.
V. T. Neal, S. Neshyba, and W. Denner.
Science, Vol 166, No 3903, p 373-374, Oct 1969. 2 p, 1 fig, 4 ref.

Descriptors: *Thermal stratification, *Arctic ocean, *Electronic equipment, Interfaces, Isotherms, Density currents, Heat flow, Mass transfer, Deep water, Methodology.
Identifiers: *Thermal structure, Vertical profiles, Deep sea research.

Sophisticated electronic systems now in use by oceanographers to obtain continuous temperature and salinity profiles show that the vertical temperature profile in the oceans may be complex. Fine scale vertical temperature measurements in an Arctic water column are described; they show the presence of several cascaded isothermal layers. Layers between depths of 300 and 350 meters range from 2 to 10 meters in thickness, while the temperature change between adjacent layers is approximately 0.026 deg C. The individual layers are isothermal to within plus or minus 0.001 deg C. (Lang-USGS)
W70-00638

TIDAL FLAT EROSION BY ICE AT LA POCATIERE, ST. LAWRENCE ESTUARY,
Department of Fisheries and Forestry, Sillery (Quebec).
For primary bibliographic entry see Field 02L.
W70-00640

GLACIATION OF THE RIVER BASINS OF THE LEFT TRIBUTARIES OF THE ALAZANI AND THE PIRIKITA ALAZANI (IN GEORGIAN),
T. V. Kopadze.
Published in Georgian with Russian and English summaries. Soobshch Akad Nauk, Gruz SSR, Vol 54, No 1, p 117-120, Apr 1969. 4 p, 4 ref.

Descriptors: *River basins, Glaciation, Rivers, Topography, Altitude, Geology, Sedimentary rocks, Erosion, Glacial drift, Glaciers.
Identifiers: *USSR, Georgian SSR, Eastern Caucasus.

The relief of the eastern Caucasus has been formed by glaciation to a large extent. The glaciation of the Wurm stage in this area can be subdivided into several cycles. The glaciers of the maximum Wurm stage, on both the northern and southern slopes of the Kakhetian Kavkazioni, reached an absolute height of 1800-2000 m. However, within the limits of Tushety, in the basin of the Pirikita Alazani River, the glaciation ended at the 7th cycle. (Gabriel-USGS)
W70-00669

HYDROLOGY OF FROZEN GROUND FLOODS,
Idaho Univ., Moscow. Water Resources Research Inst.
G. L. Bloomsburg, and S. J. Wang.
Available from the Clearinghouse as PB-187 269 $3.00 in paper copy, $0.65 in microfiche. Idaho Water Resources Research Institute, Research Technical Completion Report, June, 1969. 13 p. OWRR Project A-016-IDA.

Descriptors: *Hydrologic properties, Permeability, Porous media, *Soil properties, Frozen soils, Percolating water, Soil moisture.

A four year field and laboratory study of permeability of frozen soil is reported. The field studies involved temperature and moisture measurements over a two year period during which there were no runoff events when the ground was frozen. A rainfall simulator was constructed and used to a limited extent the second year of the study. The laboratory study involved measuring the permeability of frozen soil columns at various initial moisture contents. Air was used as a fluid to measure the permeability under isothermal conditions below 32 deg F. Data were obtained which relate the air permeability to the porosity of the soil and the moisture content or saturation at which freezing occurred. For the three soil types tested, it was possible to obtain impermeable conditions after freezing when the initial moisture content was in the neighborhood of the field capacity. The significant parameter affecting the permeability was 0 (1 - S) where 0 is the porosity and S is the saturation. The use of certain critical values of this parameter would enable a person to predict when the possibility of frozen ground floods exist by taking soil samples in the field. The critical values for various soils would have to be determined from field

permeability measurements. (Corey-Univ of Idaho)
W70-00721

PHYSICAL INFLUENCES ON FLOW SERIAL CORRELATION,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-00723

SNOWPACK MANAGEMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson.
IN Snow, Oregon State Univ, Water Resources Inst Seminar, WR 011.69, p 27-40, 1969.

Descriptors: *Snow management, *Watershed management, *Snowpacks, *Snowmelt, *Forestry, *Lumbering, Water supply, Floods, Evaporation, Condensation, Snow accumulation, Brush control, Mechanical control, Solar radiation, Advection, Streamflow, California, Colorado.
Identifiers: *Forest cutting patterns.

Summarizes results of research in California and Colorado on accumulation of snow, snowmelt, and disposition of snowmelt water as affected by forest cutting patterns, clearing of brushfields, and mechanical control of snow drifting. The implications to water yield and water supply are suggested. Revised estimates of increase in streamflow under three types of forest cuttings are given with increases the first year after cutting ranging from six inches in selection cut to 12 inches in strip cut. Duration of cutting affects on snow accumulation and soil moisture savings are given. Data are shown which indicate that snowmelt contribution to floodwaters may be mostly due to sensible heat of condensation during rainstorms, adding 2.7 inches of melt in a three day rain storm of 11 1/2 inches. Advection and condensation melting together added 4.1 inches and melt by rain 0.5 inches; thus snowmelt contributed 30 percent of the flood water. Differences in advection and condensation between large block-cut areas versus selection or strip-cut areas may make for significant differences in the snowmelt contribution to floodwaters between forest cutting methods.
W70-00763

2D. Evaporation and Transpiration

RESEARCH IN EVAPOTRANSPIRATION,
Nebraska Univ., Lincoln. Coll. of Agriculture and Home Economics; and Nebraska Univ., Agricultural Experiment Station.
N. J. Rosenberg, K. W. Brown, T. A. Hales, P. C. Doraiswamy, and D. E. Sandin.
Horticulture Program Rep No 73. Nebr Univ Water Resources Res Inst Proj Completion Rep, July 1969. 153 p, 47 fig, 17 tab, 85 ref. OWRR Proj No A-001-NEB.

Descriptors: *Evapotranspiration, *Consumptive use, Lysimeters, Evapotranspiration control, Advection, Water balance, Water loss, Energy budget, Climatology, Instrumentation, Computer programs.
Identifiers: Evapotranspiration estimating.

A lysimetric research facility was constructed at the University of Nebraska Field Laboratory at Mead. A 6-acre field was equipped for irrigation. Two precision weighing lysimeters and meteorological instrumentation were assembled, tested and combined into functional systems. Data logging and instrumental control systems were developed and integrated for study of the physics of evapotranspiration processes in the natural environment. Evaporation from bare soil was studied during 1966 after installation of the lysimeters. Data were assembled on the magnitude and rate of evaporation from bare soil under summer and fall conditions and under conditions where the lysimeter served as an oasis. Maximum summer evaporative flux was found to be on the order equivalent to an energy consumption of 1.2 cal/sq cm. Maximum 24-hr evaporation during summer was about 0.31 inches. Nocturnal evaporation accounted for about 10% of the total evaporation from bare soil. Maximum evaporation from newly seeded soil in fall was about 0.12 inches/day, with a maximum evaporative flux energy consumption during any one day of about 0.5 cal/sq cm/min. Greenhouse and field trials of antitranspirant chemical effectiveness on alfalfa were conducted during 1967 and 1968. Results to date have been contradictory. (Knapp-USGS)
W70-00450

EVAPOTRANSPIRATION CLIMATONOMY: 1. A NEW APPROACH TO NUMERICAL PREDICTION OF MONTHLY EVAPOTRANSPIRATION, RUNOFF, AND SOIL MOISTURE STORAGE,
Wisconsin Univ., Madison. Dept. of Meteorology.
H. Lettau.
Res supported in part by Atmos Sci Lab, US Army Electronics Command, Fort Huachuca, Ariz. Monthly Weather Rev, Vol 97, No 10, p 691-699, Oct 1969. 9 p, 3 tab, 13 ref. Grant No DA-AMC-28-043-66-G24 (USAEC).

Descriptors: *Evapotranspiration, *Water balance, *Climatology, Mathematical models, Mathematical studies, Hydrologic budget, Soil moisture, Evaporation, Runoff.
Identifiers: Climatonomy.

A theoretical method is given to solve the water balance equation for land areas. A forcing function is essentially determined by the product of absorbed solar energy multiplied by monthly precipitation; the response function is soil moisture in its month-to-month variations. A very simple parameter is a nondimensional surface characteristics named the 'evaporivity' (which measures the fraction of absorbed insolation utilized during the month in the vaporization of concurrent precipitation) and a characteristic lag-time interval of the order of 2 to 3 mo to express 'delayed' evapotranspiration and runoff. The solution is obtained by a closed integration of the water balance equation and yields a coherent set of data on monthly evapotranspiration, runoff, levels of exchangeable soil moisture, and storage changes. For verification, area averages for the central plains and eastern region of North America are calculated and compared with several years of actual data analyzed and evaluated by Rasmusson. In spite of simplifying tentative assumptions used in the model calculation, the agreement between predicted and observed data is improved in comparison with results of the earlier prediction methods discussed by Rasmusson. (Knapp-USGS)
W70-00654

ADVECTIVE CONTRIBUTION OF ENERGY UTILIZED IN EVAPOTRANSPIRATION BY ALFALFA IN THE EAST CENTRAL GREAT PLAINS (U.S.A.),
Nebraska Univ., Lincoln. Agricultural Experiment Station; and Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
N. J. Rosenberg.
Agricultural Meteorology, Vol 6, No 3, p 179-184, May, 1969. 2 tab, 1 fig, 12 ref. OWRR Project A-001-NEB.

Descriptors: *Great Plains, *Advection, *Evapotranspiration, *Alfalfa, *Lysimeters, Evaporation pans, Nebraska, Arizona, California, Instrumentation, Heat Budget.

Lysimetric measurements of evapotranspiration from well-watered alfalfa crops in the east-central Great Plains show that advection of sensible heat contributes an important share of the energy consumed in evaporation. Daily and hourly evapotranspiration rates were at times as great as those recorded in arid Arizona and at semiarid Davis, California. The study was conducted on a lysimeter covered with 25 cm high alfalfa located in a similarly covered 1 3/4 ha experimental field. The soil in the lysimeter and surrounding area was at field capacity at the beginning of the 3 day study. Measurements were made of air temperature, dewpoint, wind speed and direction, solar radiation, net radiation and soil heat flux. Latent heat consumption exceeded the quantity of net radiation minus soil heat flux (Rn-S) by 140, 324, and 200 ly/day, respectively. (Crouse-Arizona)
W70-00690

PATTERNS OF THE THERMAL REGIME OF THE SURFACE LAYER OF WATER,
M. P. Timofeyev, and S. P. Malevskiy-Malevich.
Translated from Meteorologiya and Gidrologiya, No 2, 1967, p 57-65. Soviet Hydrology, Selected Papers, No 1, p 102-109, 1967. 7 p, 6 tab, 2 fig, 14 ref.

Descriptors: *Air-water interface, *Water temperature, Thermal stratification, Heat transfer, Thermal conductivity.
Identifiers: USSR.

The characteristics of the thin surface layer of water, which effects the different forms of heat exchange between the free water surface and the atmosphere, were studied. Experiments in a lake and in an evaporation pan measuring 20 m sq were conducted at the Valday Hydrologic Scientific Research Laboratory to determine the average thermal conductivity coefficient of the surface layer of water. Measurements in the lake were made from a hydrologic raft. The water surface temperature and effective radiation were measured by radiometer. The water temperature profile was measured with a resistance thermometer at depths of 2, 10, 50 and down to 500 cm. and penetrating radiation was measured at depths 2, 5, 10, 30, 50, 100 and 200 cm. Meteorological elements were also determined. The difference between temperature of the water surface (Ts) and the underlying layers (Tu): Ts - Tu were determined and also for data of Lakes Sevan and Baikal and the North Atlantic Ocean. Simular computations were done for various latitudes of the Pacific Ocean along 180 deg meridian. The conclusion was that under normal conditions, except during severe storms, the temperature gradient in the upper layer of water remains negative. Thermal conductivity characteristics of the surface layer were noted as stable, with a vertical gradient. (Guerrero-Vanderbilt)
W70-00741

COMPUTATION OF THE COMPONENTS OF THE THERMAL BALANCE OF PLANNED RESERVOIRS,
L. V. Nesina.
Translation from Transactions of the Voyey Kov Main Geophysical Observatory, (Trudy GGO), No 206, p 31-37, 1967. Soviet Hydrology, Selected Papers, No 1, p 183-189, 1967. 6 p, 2 tab, 4 fig, 13 ref.

Descriptors: *Reservoirs, *Heat balance, *Evaporation, Air temperature, Water temperature, Humidity, Wind velocity.
Identifiers: Thermal balance.

A method of determining the components of the thermal balance of planned reservoirs is examined. The method is based on computations of the water surface temperature, air temperature and humidity, and wind velocity over the surface of the reservoir. Examples of the computation of the components of the thermal balance are given for reservoirs of various dimensions and depths, and the results of the computations are analyzed. Conclusions were: (1) The depth of a reservoir has a significant effect on the components of the thermal balance, and (2) The dimension of a reservoir has an insignificant effect on the components of the thermal balance. (Guerrero-Vanderbilt)
W70-00744

2E. Streamflow and Runoff

STAGE-DISCHARGE CHARACTERISTICS OF A WEIR IN A SAND-CHANNEL STREAM,
Geological Survey, Washington, D.C.
D. D. Gonzalez, C. H. Scott, and J. K. Culbertson.
Geol Surv Water-Supply Pap 1898-A, 1969. 29 p, 17 fig, 1 tab, 6 ref.

Descriptors: *Stage-discharge relations, *Gaging stations, *Control, *Flow measurement, *Water levels, Weirs, Rio Grande, Model studies, Instrumentation, Water control, Alluvial channels, Stream gages.
Identifiers: Bernardo (N Mex).

An artificial control on a sand-channel stream must control both the resistance to flow and the bed elevation in order to stabilize the relation between water-surface elevation and water discharge. The weir (control structure) in the Rio Grande conveyance channel near Bernardo, N. Mex., was designed on the basis of a model study and field data. About 72% of the measurements used to define the base relation between water-surface elevation and water discharge falls within 5% of the mean relation for the prototype. The stage-discharge relation is not affected by backwater for values of submergence less than 90%. There is no consistent relation between the ratio of measured discharge to rated discharge and submergence for values of submergence greater than 90%. When the control is drowned out, or ineffective, the relation of water-surface elevation to water discharge is virtually the same as that prior to construction of the control for discharges greater than 1,500 cfs. When the control is not drowned out the water-surface elevation for a discharge of 2,000 cfs is greater than the minimum elevation, but is less than the maximum elevation that occurred at that discharge prior to construction. (Knapp-USGS)
W70-00418

WATER RESOURCES OF RANDOLPH AND LAWRENCE COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
A. G. Lamonds, Marion S. Hines, and Raymond O. Plebuch.
Geol Surv Water-Supply Pap 1879-B, 1969. 45 p, 18 fig, 8 tab, 19 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Arkansas, Water supply, Streamflow, Water wells, Aquifers, Water quality, Water utilization, Hydrogeology, Hydrologic data, Data collections, Water yield.
Identifiers: Randolph County, Lawrence County (Ark).

Water is used at an average rate of almost 27 mgd in Randolph and Lawrence Counties, and quantities sufficient for any foreseeable use are available. Minimum recorded flows of 4 streams (Black, Current, Eleven Point, and Spring Rivers) exceeded 200 cfs, or 129 mgd 95% of the time. Water supplies can be obtained without storage from the larger streams in the area. Many of the smaller streams in the Interior Highlands also have large water-supply potential because of the excellent impoundment possibilities. Most of the water in the 2 counties is obtained from groundwater reservoirs in the Coastal Plain. Wells that tap alluvial deposits of Quaternary age commonly yield 1,000 gpm. However, the water often is unsuitable for many uses unless treated to remove hardness, iron, and manganese. Wells in the Interior Highlands generally are less than 200 ft deep and yield 10 gpm, or less. Groundwater in the Interior Highlands is very hard and is more susceptible to local bacterial contamination than is groundwater in the Coastal Plain. However, with proper sanitary safeguards against contamination and with treatment for reduction of hardness, groundwater in the Interior Highlands is suitable for most uses. (Knapp-USGS)
W70-00420

GENERALIZATION OF STREAMFLOW CHARACTERISTICS FROM DRAINAGE BASIN CHARACTERISTICS,
Geological Survey, Washington, D.C.
D. M. Thomas, and M. A. Benson.
Geol Surv Open-file Rep, 1969. 45 p, 16 fig, 11 tab, 18 ref.

Descriptors: *Rainfall-runoff relationships, *Runoff, *Runoff forecasting, *Statistical models, Regression analysis, Correlation analysis, Topography, Climates, Rainfall, Streamflow, Streamflow forecasting.
Identifiers: *Drainage basin analysis.

Statistical multiple-regression analyses provide a generalized definition of the natural streamflow in four widely separated regions of the eastern, central, southern, and western areas of the United States. In each study region, every long-term essentially natural streamflow record was characterized by 71 or more flow indices. These indices represented magnitudes of high, low, and medium flow, topography, climate, and also the distributions of flows in time. Multiple-regression analyses then defined the relation between each flow characteristic and the drainage basin characteristics. Streamflow characteristics can be defined more accurately in the humid eastern and southern regions than in the more arid western and central regions, medium flows can be more accurately defined than high flows, and low flows can be only weakly defined. Standard deviations of monthly and annual flows were found to be significantly related to basin characteristics. Some indices of flow distributions in time (serial correlation and skew coefficients) could better be described by regional averages. Regression relations may be used to estimate many natural-flow characteristics at any site in the study regions. In addition, the knowledge of basin characteristics provides a firm technical basis for modifying and improving the existing streamflow data-collection system. (Knapp-USGS)
W70-00440

HYDROGRAPH STUDY AND PEAK DISCHARGE DETERMINATION OF HAWAIIAN SMALL WATERSHEDS: ISLAND OF OAHU,
Hawaii Univ., Honolulu.
For primary bibliographic entry see Field 02A.
W70-00449

SURFACE-WATER RESOURCES OF THE YOBE RIVER SYSTEM, NORTHERN NIGERIA, 1963-68,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02A.
W70-00456

HYDROLOGIC EFFECTS OF THE EARTHQUAKE OF MARCH 27, 1964, OUTSIDE ALASKA,
Geological Survey, Washington, D.C.
Robert C. Vorhis.
Geol Surv Prof Pap 544-C, p C1-C54, 1967. 54 p, 24 fig, 7 tab, 63 ref.

Descriptors: *Earthquakes, *Alaska, *Water level fluctuations, *Data collections, Surface waters, Groundwater, Lakes, Streams, Water wells, Aquifers, Seismic waves, Seiches, Tsunamis, Hydrologic data, Hydrogeology.
Identifiers: Earthquake hydrologic effects, Seismic seiches, Hydroseisms.

The Alaska earthquake of March 27, 1964, had widespread hydrologic effects throughout practically all of the United States. More than 1,450 water-level recorders, scattered throughout all the 50 States except Connecticut, Delaware, and Rhode Island, registered the earthquake. The earthquake is also known to have registered on water-level recorders on wells in Canada, England, Denmark, Belgium, Egypt, Israel, Libya, Philippine Islands, South-West Africa, South Africa, and Northern Territory of Australia. The Alaska earthquake is the first for which widespread surface-water effects are known. The effects were recorded at stations on flowing streams, rivers, reservoirs, lakes, and ponds. Most of the fluctuations recorded can be referred to more precisely as seismic seiches; however, a few stations recorded the quake as a minor change in stage. The largest recorded seiche outside Alaska was 1.83 ft on a reservoir in Michigan. The next largest was 1.45 ft on Lake Ouachita in Arkansas. The largest fluctuation in a well was 23 ft registered by a pressure recorder near Belle Fourche, S. Dak. Fluctuations of more than 10 ft were reported from wells in Alabama, Florida, Georgia, Illinois, Missouri, and Pennsylvania. A 3.40 ft fluctuation was recorded in a well in Puerto Rico. (Knapp-USGS)
W70-00467

CORRELATION AND ANALYSIS OF WATER-TERMPERATURE DATA FOR OREGON STREAMS,
Geological Survey, Washington, D.C.
A. M. Moore.
Geol Surv Water-Supply Pap 1819-K, p K1-K53, 1967. 53 p, 10 fig, 1 plate, 6 tab, 7 ref.

Descriptors: *Water temperature, *Correlation analysis, *Streamflow, *Surveys, *Oregon, Water quality, Thermometers, Surface waters, Forecasting, Data collections, Hydrologic data.
Identifiers: Oregon stream water temperatures, Thermographs.

Procedures are developed to correlate spot observations of water temperature with a representative thermograph record to estimate monthly means and extremes at the site where the spot observations were made. In general, these synthetic figures represent probable water temperatures at the spot-observation site during the period of record for the thermograph site. Tests indicate that the average errors in the estimates of monthly means and extremes are about 1 deg and 2 deg, respectively in the Oregon streams measured. The correlations are useful in assessing the effect of reservoirs on downstream water temperatures. The accuracy of the instruments and the methods used by the Geological Survey result in water-temperature records that are considered to be accurate within about 1 deg. Because water temperature in a given month varies from year to year, 2 rough guides are developed to assist in appraising short-term records with respect to long-term means and extremes of water temperature. The cold summer of 1955 and the warm summer of 1958 contain extremes that represent at least 25-year events. During the summer months, water temperature varies considerably even during one day. The amount of diurnal fluctuation can be significant and, in natural streams, depends largely on the amount of solar radiation absorbed, the amount of water to be warmed or cooled, and the amount and location of contributory spring flow. The maximum diurnal fluctuation at 129 thermograph sites is shown in tabular form. This listing can be used to estimate maximum diurnal fluctuation of water temperature in streams for which no thermograph records are available. (Knapp-USGS)
W70-00470

SURFACE WATER AND RELATED CLIMATE FEATURES OF THE SAHIL SUSAH AREA, TUNISIA,
Geological Survey, Washington, D.C.
L. C. Dutcher, and H. E. Thomas.
Geol Surv Water-Supply Pap 1757-F, p F1-F40, 1967. 40 p, 10 fig, 4 plate, 12 ref.

Descriptors: *Water supply, *Climates, *Surface waters, Runoff, Streamflow, Water resources, Arid lands, Rainfall-runoff relationships, Irrigation water, Municipal water.
Identifiers: Sahil Susah area (Tunisia).

The water supplies available to the people of central Tunisia are discussed. About 80% of the areas people inhabit the Sahil Susah (coastal area) and

the bordering Low Steppe. These lowlands receive water directly by precipitation and also by surface and underground flow from the High Steppe and the mountains. The median annual precipitation upon the Sahil and Low Steppe is about 280 mm which is less than one-fourth of the potential annual evaporation rate, and even in the winter 'rainy' season precipitation is less than half the evaporation rate. Thus on the basis of averages there is a net water deficiency throughout the year. In about 10% of the past 60 yr, precipitation has been great enough to sustain nonirrigated agriculture. In nearly 50% of the years, precipitation has contributed so little water to the soil that most crops not close enough to the coast to benefit from the nocturnal humidity there would fail without irrigation. The temporary excesses in precipitation provide occasional surpluses of water. Available records indicate that the streams draining the mountain range on the northwest (Dorsale) in central Tunisia have high maxima and flash-flood runoff but negligible flow in rainless periods. High evaporation losses, increasing salinity, sediment accumulation in reservoirs, and lack of suitable sites for dams or reservoirs are formidable handicaps to surface storage. For perennial supply, the surface flow should be stored in suitable groundwater reservoirs from which it could be pumped out as needed. (Knapp-USGS)
W70-00471

HYDROLOGIC DATA FOR THE OAK RIDGE AREA, TENNESSEE,
Geological Survey, Washington, D.C.
William M. McMaster.
Geol Sur Water-Supply Pap 1839-N, p N1-N60, 1967. 60 p, 21 fig, 13 tab, 36 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Surveys, *Tennessee, Streamflow, Low flow, Aquifers, Water yield, Water quality, Water utilization, Hydrogeology, Hydrologic data, Data collections.
Identifiers: *Oak Ridge (Tenn).

The Oak Ridge, Tenn., area is abundantly supplied with water. Annual rainfall ranges from 46 inches in the northeastern part of the area to more than 58 inches in the northwestern part; areal mean rainfall is 51.2 inches. Streamflows equaled or exceeded 90% of the time range from 0.04 cfsm for streams draining areas underlain entirely by sandstone and shale to 0.58 cfsm for streams draining areas underlain mostly by dolomite and limestone. The Knox Dolomite is the principal aquifer of the area; several large springs flow from the Knox, the largest of which is Bacon Spring, which has a mean discharge of about 3.8 cfs. Groundwater is not adequate as a source of large supply. It is estimated that the average well in the area would yield not more than 10 gpm and that very few wells would yield more than 50 gpm. In general, the water in streams in the Oak Ridge area is moderately hard to very hard and has a low content of sodium, potassium, and chloride. Four streams receive industrial or municipal wastes which alter their chemical quality. Several of the small streams in the Oak Ridge area are used for waste disposal, and one is used as a part of an arboretum. Groundwater development is small; at present, several springs are used for community or utility district supplies. Very large supplies of surface water from the Clinch River are presently developed in the area. Most of this supply is used by U.S. Atomic Energy Commission and Tennessee Valley Authority facilities. (Knapp-USGS)
W70-00476

RUNOFF FROM SMALL PEATLAND WATERSHEDS,
Forest Service (USDA), Grand Rapids, Minn. Northern Conifers Lab.
Roger R. Bay.
J Hydrol, Vol 9, No 1, p 90-102, Sept 1969. 13 p, 6 fig, 1 tab, 7 ref.

Descriptors: *Runoff, *Water storage, *Bogs, *Minnesota, *Low flow, Recession curves, Rainfall-runoff relationships, River regulation, Hydrographs, Streamflow forecasting, Precipitation (Atmospheric), Infiltration, Water yield, Small watersheds.
Identifiers: Peat bogs, Bog watersheds.

Runoff was measured on 4 forested bog watersheds in northern Minnesota for 5 years. The experimental basins ranged in size from 24 to 130 acres and included both organic and mineral soils. Annual runoff was not evenly distributed. Spring runoff, from the beginning of flow in late March to the 1st of June, accounted for 66% of total annual water yield. Summer and fall runoff was normally very low and ceased on most of the bogs during each summer. Annual peak rates of discharge were low and recessions were long, indicating the bogs were effective as storage areas for short-term runoff. However, they were not effective as long-term storage areas or regulators of streamflow. (Knapp-USGS)
W70-00675

SURFACE WATER IN THE ERIE-NIAGARA BASIN, NEW YORK,
Geological Survey, Albany, N.Y.
W. E. Harding, B. K. Gilbert, and R. M. Beall.
NY State Water Resources Comm Basin Planning Rep ENB-2, 1968. 118 p, 42 fig, 6 plate, 16 tab, 20 ref, append.

Descriptors: *Streamflow, *Surface waters, *New York, *Data collections, *Hydrologic data, Surveys, Gaging stations, Floods, Hydrographs, Draft-storage curves, Precipitation (Atmospheric), Runoff.
Identifiers: Erie-Niagara Basin (NY).

The Erie-Niagara basin contains about 2,000 sq mi in western New York State. The drainage systems of the area discharge into Lake Erie and the Niagara River at an average rate of about 1,730 mgd. Annual precipitation ranges from about 32 to 44 inches. Evapotranspiration losses account for about 20 inches of water a year and the streams have an average annual runoff of about 18 inches. Mean annual runoff in the area increases as a function of the direct relationship between precipitation and elevation of the land surface; therefore, a map on a topographic base was developed from which mean annual runoff can be estimated for any stream in the area. Other maps present the regional distribution of flow at the 50, 90, and 99% duration points. Low-flow frequency analyses show the minimum flows expected to recur at various intervals of time for periods of 1, 7 and 30 consecutive days. Studies of high flows provided the basis for a regional analysis of flood frequency for streams with drainage areas larger than 10 square miles. Overbank flooding in the Erie-Niagara basin is most extensive in the Tonawanda Creek basin. Many floods are the result of the formation of ice jams, both in stream channels and at the mouths of streams entering Lake Erie, and are not necessarily caused by unusually high streamflows. (Knapp-USGS)
W70-00689

RECONNAISSANCE ESTIMATION OF STREAM DISCHARGE-FREQUENCY RELATIONSHIPS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
K. D. Woodyer, and P.M. Fleming.
In: G A Stewart, Ed, Land Evaluation Papers of a CSIRO Symposium in Cooperation with UNESCO August 26-31, 1968, Macmillan of Australia, p287-298, 1968. 3 fig, 2 tab, 25 ref.

Descriptors: *Stream flow, *Discharge measurement, *Peak discharge, *Watersheds (Basins), *Stage-discharge relations, Mannings Equation, Frequency, Small watersheds, Estimating, Data collections.
Identifiers: *Australia, *New South Wales, Queensland.

This paper examines the feasibility of assessing stream flow on the basis of a reconnaissance survey of streams from small catchments of less than 100 sq. miles. Large sums of money are expended on numerous small works, such as road bridges and culverts, where time and money are not available for collection of long term stream flow data. Bankfull level was identified for streams in New South Wales on the basis of channel monopoly and vegetation. The data collected showed bankfull frequency to be a promising index for estimation of discharge-frequency relationships. A fixed frequency technique appears best suited for extrapolating from the base flood frequency. This method does not require rainfall observations. It represents an integration of all catchment characteristics. (Crouse-Arizona)
W70-00698

HYDROLOGY OF FROZEN GROUND FLOODS,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 02C.
W70-00721

PHYSICAL INFLUENCES ON FLOW SERIAL CORRELATION,
Washington Univ., Seattle. Dept. of Civil Engineering.
William J. Stolte, and Thomas H. Campbell.
Technical Report No 27. Available from the Clearinghouse as PB-187271, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Washington Water Research Center, June 1969. 97 p, 27 fig, 4 tab, 34 ref. OWRR Project A-020-WASH.

Descriptors: *Runoff, Hydrology, Streamflow, Synthesis, Washington, Contours, Water storage, Snowmelt.

The effects of basin geometry and water storage capacity, rainfall, snow accumulation, and snowmelt on the lag-one monthly and annual serial correlation in the streamflow of Western Washington are examined by means of contouring and multivariate analyses. It is found that rainfall, snow accumulation, and snowmelt strongly influence the variation in the monthly flow serial correlation from basin to basin while the corresponding influence of basin geometry and water storage capacity is quite weak. The effect of these factors on the annual flow serial correlation is indirect and difficult to explain.
W70-00723

STATISTICAL ANALYSIS OF MEANDERING RIVER GEOMETRY,
Purdue Univ., Lafayette, Ind.
T. P. Chang, and G. H. Toebes.
Available from the Clearinghouse as PB-187 273, $3.00 in paper copy, $0.65 in microfiche. Purdue University Water Resources Research Center Technical Report No 7, June 1969. 162 p, 16 tab, 46 fig, 56 ref. OWRR Project A-003-IND.

Descriptors: *Meanders, *Channel morphology, Flood plains, Geomorphology, Rivers, Stream erosion, River beds, Thalweg, Profiles, Channel discharge, Bank stability, Channel shape, Channel depth, Channel width.
Identifiers: Wabash River, White River.

An investigation of the geometry of two natural meandering rivers, the Wabash River and the White River in Indiana, is described. Local curvature series were used to describe the meandering intensity. The power spectra of local curvature series were adopted to characterize the meander wavelengths. Relationships between absolute curvature, width, thalweg depth and cross sectional area have been suggested by their cross-correlation functions and cross-spectra. Two groups of factors: (1) geology and soil; (2) flow rate and channel

slope were postulated to be major factors to affect the meander planform for the rivers studied. A program to analyze the non-stationary data has been developed and applied to the curvature series. It appears to provide an objective way to describe details of a meandering river.
W70-00725

2F. Groundwater

WATER RESOURCES OF RANDOLPH AND LAWRENCE COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-00420

GROUND-WATER CONDITIONS IN McMULLEN VALLEY, MARICOPA, YUMA AND YAVAPAI COUNTIES, ARIZONA,
Geological Survey, Phoenix, Ariz.
P. C. Briggs.
Ariz State Land Dep Water-Resources Rep No 40, July 1969. 31 p, 9 fig, 4 tab, 2 ref, append.

Descriptors: *Groundwater, *Arizona, *Water level fluctuations, *Aquifers, Alluvium, Water yield, Water supply, Water quality, Irrigation water, Hydrologic data, Data collections.
Identifiers: McMullen Valley (Ariz).

Pumping of groundwater in McMullen Valley, Arizona is concentrated mainly in two areas - the Salome-Wenden area, which is near the outlet of the valley, and the Aguila area, which is about 25 miles farther upstream. In the Salome-Wenden area about 8,000 acre-ft of groundwater was withdrawn in 1957 and about 40,000 acre-ft was withdrawn in 1965; in the Aguila area 13,000 acre-ft was withdrawn in 1957 and 50,000 acre-ft was withdrawn in 1965. The withdrawal has caused water-level declines, changes in the flow pattern, and a decrease in the amount of groundwater in storage. Near Aguila, the water-level decline was more than 70 ft, and northeast of the Wenden area the decline was as much as 60 ft in the 7-year period 1958-65. In an area in Harrisburg Valley southeast of Salome there was no net change in water level in the 7-year period. Rises in water level, which offset declines, probably were caused by recharge from the surface water ponded behind a flood-control dam. In general, the ground water in McMullen Valley is well suited for irrigation because of the low dissolved-solids content, but in places the different dissolved constituents limit its use, depending on the soil type and crop being grown. The fluoride content of the water, however, is from 2 to 10 times the maximum recommended for drinking water. (Knapp-USGS)
W70-00426

OXIDIZING-REDUCING CONDITIONS OF THE 'NAFTUSIA' MINERAL WATERS FORMATION (RUSSIAN),
For primary bibliographic entry see Field 02K.
W70-00428

HYDROLOGY OF SOUTH BONAIRE, N. A. - A ROCK SELECTIVE DOLOMITIZATION MODEL,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Geology.
R. C. Murray.
J Sediment Petrol, Vol 39, No 3, p 1007-1013, Sept 1969. 7 p, 6 fig, 9 ref.

Descriptors: *Diagenesis, *Limestones, *Dolomite, Hydrogeology, Aquifers, Evaporation, Groundwater movement, Water circulation, Karst, Chemical reductions, Water chemistry, Sea water.
Identifiers: *Dolomitization, *Netherlands, Antilles.

Study of the hydrology of the south end of the island of Bonaire, Netherlands Antilles, indicates that flow of fresh sea water onto land takes place through permeability conduits in the underlying rock and emerges as numerous springs. Reflux of some heavy brine is probably continuously taking place because of gravitational instability. In addition, evidence suggest a major annual reflux event in early summer that causes a significant loss of heavy brine. This annual event is controlled by the total pressure of the brine exerted at the level of an impermeable clay layer within the recent sediments being greater than the pressure exerted by the sea water at equivalent level. This annual return flow of brine moves through some of the same permeability conduits that supply fresh water through most of the year. Dolomite formed by such a hydrology should be confined to the permeability paths underneath an evaporite sediment in older rocks. This pattern of rock-selective or permeability-controlled dolomitization may be common in ancient rocks. (Knapp-USGS)
W70-00441

REDUCING LAND SUBSIDENCE IN THE WILMINGTON OIL FIELD BY THE USE OF SALINE WATERS,
Long Beach Dept. of Oil Properties, Calif.
For primary bibliographic entry see Field 05G.
W70-00447

LIMESTONE HYDROLOGY IN THE UPPER STONES RIVER BASIN, CENTRAL TENNESSEE,
Geological Survey, Washington, D.C.
G. K. Moore, C. R. Burchett, and R. H. Bingham.
Tenn Dep Conserv, Div of Water Rep, 1969. 58 p, 29 fig, 3 plate, 2 tab, 32 ref.

Descriptors: *Groundwater, *Karst, *Carbonate rocks, *Tennessee, Water wells, Groundwater movement, Water supply, Water yield, Permeability, Porosity, Hydrologic data, Data collections, Hydrogeology, Water levels, Springs, Recharge.
Identifiers: Stones River basin (Tenn).

The available evidence indicates that the solution cavities of the limestones of the Upper Stones River Basin, Tennessee range from a fraction of an inch to several inches high, from several tens of feet to several hundred feet wide, and from a fraction of a mile to several miles long. The hydrographs of 4 observation wells indicate that recharge is limited to specific areas, and that solution cavities function only as pipelines to carry water from the recharge area to the discharge area. Nearly all recharge and discharge occurs through open joints. Sinkholes are important recharge centers. Groundwater moves generally from the uplands to the streams. A map of groundwater levels in the basin does not reflect hydraulic gradients within individual solution cavities except across short distances. Instead, the map shows the water-level differences between essentially horizontal solution cavities at various depths. Some solution-cavity segments are joint controlled. Also, slightly higher well yields are obtained where thick soils are developed along joints. Joint direction and soil thickness should be considered in selecting test-well locations. (Knapp-USGS)
W70-00451

HYDROLOGY OF CARBONATE ROCK TERRANES, A REVIEW-WITH SPECIAL REFERENCE TO THE UNITED STATES (PART 1),
Geological Survey, Washington, D.C.; and Geological Survey, Raleigh, N.C.
V. T. Stringfield, and H. E. LeGrand.
J Hydrol, Vol 8, No 3, p 349-376, July 1969. 28 p, 4 fig.

Descriptors: *Hydrogeology, *Carbonate rocks, *Karst, *Reviews, Caves, Drainage effects, Groundwater movement, Limestones, Subsurface drainage, Topography, Geology.
Identifiers: Karst hydrology.

Limestone and other carbonate rocks are characterized by many unusual features and extreme conditions, either involving the hydrologic system within them or wrought by hydrologic conditions on them or through them. The need for knowing the specific geologic and hydrologic conditions at various places in limestone terranes, as well as the variations in hydrologic conditions with changing conditions and time, has resulted in many published reports on local areas and on special topical problems of limestone hydrology. Many of these reports have been used to advantage. The concept that secondary permeability is developed by circulation of water through openings with the accompanying enlargement of these openings by solution is now universally accepted in limestone terranes. Emphasis is placed on the hydrogeologic framework, or structural setting, in relation to the ease or difficulty of water to move from a source of recharge, through a part of the limestone, to a discharge area. Parts of the limestone favored by circulating ground water tend to develop solution openings, commonly in the upper part of the zone of saturation; as base level is lowered (sea level or perennial stream level), the related water table lowers in the limestone leaving air-filled caverns above the present zone of saturation in sinkhole areas. Reconstruction of the geologic and hydrologic history of a limestone area aids in determining the extent of development and the positions of fossil and present permeability. References are made to the hydrology of many limestone regions, especially those of the United States. (Knapp-USGS)
W70-00454

RESULTS OF SUBSURFACE EXPLORATION IN THE MID-ISLAND AREA OF WESTERN SUFFOLK COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Albany, N.Y.
Julian Soren.
Geol Surv Open-file Rep, July 1969. 90 p, 4 fig, 6 plate, 2 tab, 19 ref, append.

Descriptors: *Water resources, *Water supply, *Groundwater, *Surveys, *New York, Aquifers, Water levels, Water quality, Hydrologic data, Data collections, Hydrogeology, Water wells, Water level fluctuations, Hydrographs, Glacial drift.
Identifiers: Long Island (NY).

The mid-island area of western Suffolk County, Long Island, N.Y., is an area of about 140 sq mi which extends from the western border of the county to Lake Ronkonkoma. A program of test drilling and data collection was undertaken in 1963 to obtain information on the local geohydrology. Results of the work show that: the area is underlain by thick unconsolidated aquifers of moderate to high permeability; the water in the aquifers is of good quality for domestic and industrial uses; and sufficient groundwater of good quality should be available for at least several decades. Groundwater pumping in the area increased greatly to maintain adequate supplies for the growing population. In 1968, about 33 mgd was pumped, which was an increase of about 2.5 times the average pumpage in 1958. From 1903 to 1968, the water-table decline ranged from about 5 ft, in the eastern part of the area, to as much as about 40 ft, in the western part. The decline of the water table reflects the loss of about 30 billion gallons of groundwater in storage. An additional loss of groundwater in storage is anticipated as a result of increased pumpage and increased urbanization. (Knapp-USGS)
W70-00455

GEOLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
Iowa State Univ., Ames. Dept. of Earth Sciences.
Lyle V. A. Sendlein, Donald E. Henkel, and Keith Hussey.
Iowa State Univ Water Resources Res Inst Proj Completion Rep, June 30, 1968. 29p, 6 fig, 42 ref. OWRR Proj No A-012-IA.

Descriptors: *Hydrogeology, *Hydrologic budget, *Aquifers, *Glacial drift, *Iowa, Groundwater movement, Mapping, Surveys, Geology, Sands, Gravels.

Identifiers: Nishnabotna Basin, Buried valleys.

In the analysis of the water budget of basins the one variable generally assumed to be constant is groundwater inflow and outflow. An investigation was made to evaluate the validity of this assumption in a glacial terrain underlain by a bedrock valley system. With the integrated use of geologic and geophysical data a major bedrock valley, the northern extension of a major buried valley system of Missouri was mapped. Sand and gravel deposits were found in segments of the buried valley and as a basal drift unit on the bedrock upland surface. Bedrock which subcrops in the basin is Pennsylvanian in the southern half both on the upland and in the buried valley. In the northern portion it is Cretaceous on the upland and Pennsylvanian in the valleys. The application of the seismic refraction electrical resistivity methods proved valuable and economical. The full report is available through the Iowa State Water Resources Research Institute, Ames, Iowa. (Knapp-USGS)
W70-00458

FORCES ACTING UPON THE SOLID PHASE OF A POROUS MEDIUM,
Agricultural Research Service, Madison, Wis.
For primary bibliographic entry see Field 02G.
W70-00459

GROUNDWATER RESOURCES OF MONMOUTH COUNTY, NEW JERSEY,
Geological Survey, Trenton, N.J.
Leo A. Jablonski.
N J Div Water Policy and Supply Spec Rep No 23, 1968. 117 p, 27 fig, 5 tab, 32 ref.

Descriptors: *Water resources, *Groundwater, *New Jersey, Surveys, Data collections, Hydrologic data, Aquifers, Water wells, Water yield, Water quality, Saline water intrusion, Hydrographs, Hydrogeology, Duration curves.
Identifiers: Monmouth County (NJ).

Monmouth County includes an area of 538 sq mi in east-central New Jersey. The climate is characteristized by moderate temperature, moderate humidity, and moderate precipitation. Groundwater constituted about 50% of the total water use in 1958. The daily withdrawal of groundwater was at an average rate of 21.6 mgd in 1958 and about 32 mgd in 1965. The water demand is expected to increase to about 133 mgd by the year 2000. An anlaysis of streamflow records for the period 1932 to 1950 suggests that, excluding the Raritan and Magothy Formations, the major aquifers that occur under water-table conditions in the county discharge an average of about 178 mgd to streams. Because salt water has been found in the lower parts of these formations in Ocean County, further development should proceed watchfully to assure that salt water does not threaten existing supplies. Aquifers in the Raritan and Magothy Formations and the Englishtown Formation supplied 76% of the groundwater used in 1958. These aquifers, in conjunction with the Wenonah Formation and Mount Laurel Sand of Late Cretaceous age, are capable of providing relatively large yields to wells. The average yield of 63 large-diameter wells tapping these aquifers is 580 gpm, at depths ranging from 100 to 1,140 ft. In general, the concentrations of chemical constituents in water from the aquifers would not restrict the use of the water for most purposes. High concentrations of iron do occur and require treatment. The concentrations of dissolved solids in 39 of 41 samples were 160 ppm or less. (Knapp-USGS)
W70-00465

HYDROLOGIC EFFECTS OF THE EARTHQUAKE OF MARCH 27, 1964, OUTSIDE ALASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-00467

GROUNDWATER RECONNAISSANCE IN THE BURNT RIVER VALLEY AREA, OREGON,
Geological Survey, Washington, D.C.
Don Price.
Geol Surv Water-Supply Pap 1839-I, 1967. 27 p, 7 fig, 1 plate, 3 tab, 14 ref.

Descriptors: *Water resources, *Groundwater, *Surveys, *Oregon, Water wells, Water yield, Water quality, Data collections, Hydrologic data, Hydrogeology, Water levels, Aquifers, Gravels, Basalts.
Identifiers: *Burnt River Valley (Oregon).

The Burnt River valley area in southern Baker and northern Malheur Counties, Oreg., is underlain by rocks that range in age from pre-Tertiary to Quarternary. The pre-Tertiary rocks and most of the Tertiary rocks that underlie the map area have relatively low permeability and yield water slowly to wells and springs. Potentially productive aquifers occur in the Quaternary alluvium in the Burnt River and Willow Creek valleys, in the fluviolacustrine deposits, and in basaltic lava flows that extend beneath the valley floors. Fluviolacustrine deposits yield only small to moderate quantities of water, generally less than 50 gpm, to wells, but they contain gravel lenses locally which could yield moderate to large quantities of water. Basaltic rocks that are intercalated with and extend beneath the fluviolacustrine deposits near Huntington and in Willow Creek valley yield moderate to large quantities of water (as much as 1,000 gpm) to wells; however, those rocks are of limited extent in the study area and in most places appear to lie above the regional water table. The groundwater is chemically suitable for irrigation of most crops that can be grown under the climatic conditions of the area. However, samples collected from 2 wells that tap the fluviolacustrine deposits, one near Durkee and the other near Bridgeport, were classified as having very high sodium and a high salinity hazard; those samples also contained concentrations of boron that could be toxic to some plants. (Knapp-USGS)
W70-00468

FLUID DYNAMICS OF MULTIPHASE SYSTEMS,
Illinois Univ., Urbana. Dept. of Mechanical Engineering.
S. L. Soo.
Waltham, Mass, Blaisdell Publishing Co, 1967. 524 p, 206 fig, 8 tab, 886 ref.

Descriptors: *Fluid mechanics, *Suspension, Flow, Porous media, Turbulent flow, Laminar flow, Dynamics, Dispersion, Flocculation, Closed conduit flow, Compressible flow, Flow characteristics, Hydrodynamics, Sediment transport, Suspended load, Deposition (Sediments).
Identifiers: *Multiphase flow.

Basic concepts of multiphase fluid dynamics are discussed in a textbook intended for students in advanced graduate courses and for laboratory reseachers. The primary concern of the discussion is with particulate clouds, but flow in porous media, turbulent flow, sedimentation, and suspensions are also comprehensively presented. Topics include rigid particle transport, deformable particle transport, pipe flow of a suspension, particle-cloud transport properties, basic equations of multiphase systems, gas dynamics of suspensions, hydrodynamics of suspensions, sedimentation, fluidization, packed beds, and electrodynamics. A comprehensive bibliography and review of the literature of ideas and methods in fluid mechanics is included. (Knapp-USGS)
W70-00469

AVAILABILITY OF GROUND WATER IN YORK COUNTY, NEBRASKA,
Geological Survey, Washington, D.C.
C. F. Keech, V. H. Dreeszen, and P. A. Emery.
Geol Surv Water-Supply Pap 1839-F, p F1-F17, 1967. 17 p, 3 fig, 2 plate, 1 tab, 11 ref.

Descriptors: *Water resources, *Groundwater, *Surveys, *Nebraska, Aquifers, Water yield, Water wells, Hydrogeology, Hydrologic data, Data collections, Water level fluctuations, Water quality, Water supply, Irrigation water.
Identifiers: York County (Nebr).

York County, an area of 575 sq mi, is situated on an upland plain in southeast Nebraska. Although tributaries of the Big Blue River have eroded valleys into this plain, much of the original surface is still intact and is characterized by broad shallow undrained depressions. More than 111,000 acres of cropland was irrigated in 1964 with water pumped from 1,240 wells. The upland plain is underlain to depths of 100-450 ft by unconsolidated deposits of Quaternary age. The unconsolidated Quaternary deposits mantle the eroded surface of marine strata of Cretaceous age. The lower unconsolidated rocks of Quaternary age are saturated and constitute a highly productive aquifer throughout much of the county. Replenishment to this aquifer, derived principally from precipitation, averages about 1.5 inches per year. As the quantity of ground water pumped per year greatly exceeds the average annual quantity of recharge, most of the water used for irrigation is from storage. Consequently, water levels have been trending downward. A comparison of 1964 water levels in wells with water levels measured in 1953 shows that the water table declined more than 10 ft. beneath 42 sq mi. The ground water is of the calcium bicarbonate type, and, though hard, is chemically suitable for irrigation use on most soils in the county. (Knapp-USGS)
W70-00472

HYDROLOGIC DATA FOR THE OAK RIDGE AREA, TENNESSEE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-00476

GROUNDWATER RESOURCES OF THE PASCAGOULA RIVER BASIN, MISSISSIPPI AND ALABAMA,
Geological Survey, Washington, D.C.
Roy Newcome, Jr.
Geol Surv Water-Supply Pap 1839-K, p K1-K36, 1967. 36 p, 12 fig, 4 tab, 17 ref.

Descriptors: *Water resources, *Groundwater, *Mississippi, *Alabama, Aquifers, Water wells, Artesian wells, Water yield, Water quality, Hydrogeology, Water supply, Water levels, Hydrologic data, Data collections.
Identifiers: Pascagoula River Basin (Miss-Ala).

Abundant groundwater resources underlie the Pascagoula River basin, Mississippi. These resources have been developed intensively only in Hattiesburg, Laurel, Meridian, and Pascagoula. The fresh-water-bearing section is 300 to 3,500 ft thick and is composed chiefly of sand and clay of Eocene to Recent age. Major rock units represented are the Wilcox, Claiborne, Jackson, and Vicksburg Groups and formations of Miocene and Pliocene ages. Aquifers in the Claiborne Group provide water for all purposes in the northern third of the basin. The Claiborne is underlain by the potentially important but virtually untapped Wilcox Group. Miocene aquifers are the main source of water supplies in the southern half of the basin, but Pliocene aquifers furnish most supplies in the Jackson County area at the basin's southern extremity. Groundwater levels are within 50 ft of the surface in most places, and flowing wells are common in the valleys and near the coast. Water-level declines due to pumping have become serious problems only in a few localities of heavy withdrawal. Although few wells in the basin yield more than 500 gpm, yields of 1,000 gpm or more could be reasonably expected from efficiently constructed wells almost anywhere in the region. The groundwater is of good to excellent quality. Saltwater encroachment is a potential problem in the coastal area, but little increase in salinity has been observed in monitor wells in the period 1960-65.

Saline-water resources are available for development at considerable depth in most of the region. (Knapp-USGS)
W70-00477

AN INEXPENSIVE METHOD FOR DETERMINING THE DIRECTION OF NATURAL FLOW OF GROUNDWATER,
Irrigation Research Inst., Lahore (Pakistan).
Mohammad Saleem.
J Hydrol, Vol 9, No 1, p 73-89, Sept 1969. 17 p, 5 fig, 10 ref, append.

Descriptors: *Groundwater movement, *Tracers, Tracking techniques, Monitoring, Water wells, Instrumentation, Mathematical studies, Drainage, Percolation.
Identifiers: Groundwater tracers.

Groundwater flow is a vector quantity, the magnitude of which can be easily determined in situ by measuring the rate of dilution of a tracer in a borehole with perforated screen, called the 'Master-well'. Knowing the magnitude, the direction then can easily be evaluated by introducing another vector quantity of known magnitude and direction and then finally measuring the magnitude of the resultant flow. This new vector can be introduced by pumping a tube-well at some convenient distance from the master-well. All flow measurements are carried out in the same master-well. If the tracer used is not radioactive, the dilution rates are computed by measuring the electrical conductivities using low voltage and low frequency A.C. (Knapp-USGS)
W70-00635

PORE STUDIES OF HIGHLY INDURATED APPALACHIAN ROCKS,
Virginia Univ., Charlottesville. Dept. of Geology; Virginia Highway Research Council, Charlottesville; and Cities Service Oil Co., Tulsa, Okla.
W. Cullen Sherwood, and Jinn Huie Huang.
The Amer Ass Petrol Geol Bull, Vol 53, No 10, Part 1, p 2161-2170, Oct 1969. 10 p, 12 fig, 2 tab, 22 ref.

Descriptors: *Porosity, *Carbonate rocks, *Metamorphic rocks, *Appalachian Mountain Region, Fractures (Geology), Permeability, Pores, Rock properties, Void ratio, Voids, Groundwater movement.
Identifiers: Pore geometry, Porosimetry.

The porosity and pore-size distribution of highly indurated carbonate rocks and igneous and metamorphic silicate rocks from the Valley and Ridge and Piedmont provinces in Virginia were studied by mercury-porosimetry, specific-gravity, and petrographic techniques. Porosity values range from 0.19 to 3.66%, and mean pore diameters from 0.010 to 0.866 microns. Fundamental differences in the character of pores were noted between the igneous and metamorphic rocks and the carbonate rocks. Pores in the individual crystalline rocks are concentrated predominantly at 2 to 4 different sizes, whereas those in the carbonate rocks generally are of one size. Also the mean pore diameters in the carbonate rocks are generally smaller; the pores are of a lesser size range than those in the igneous and metamorphic rocks, but the porosity of the carbonate rocks generally is higher and shows a greater variation. The low porosity and small pores measured in the dolomitic rocks from Virginia appear to indicate that most dolomitization preceded the strong compactive forces of Appalachian folding. (Knapp-USGS)
W70-00659

DETERMINATION OF DEPENDENCE BETWEEN FILTRATION CHARACTERISTICS OF DRAINAGE CANALS (IN RUSSIAN),
Akademiya Nauk Gruzinskoi SSR, Tiflis.
For primary bibliographic entry see Field 04A.
W70-00663

A LIMNOLOGICAL STUDY OF A TENNESSEE COLD SPRINGBROOK,
Tennessee Rechnological Univ., Cookeville. Dept. of Biology.
For primary bibliographic entry see Field 02I.
W70-00672

WATER BUDGET STUDIES IN KARST AQUIFERS,
McMaster Univ., Hamilton (Ontario). Dept. of Geography; and Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
M. C. Brown, T. L. Wigley, and D. C. Ford.
J Hydrol, Vol 9, No 1, p 113-116, Sept 1969. 4 p, 2 fig, 16 ref.

Descriptors: *Tracers, *Karst, *Aquifers, *Limestones, Groundwater movement, Dye releases, Tracking techniques, Springs, Streamflow, Sinks, Subsurface drainage, Instrumentation, Hydrologic budget.
Identifiers: Stream gaging, Springflow gaging.

The use of tracers in limestone hydrology studies is discussed and an example of the use of Rhodamine-WT in a study of a karst aquifer in British Columbia is given. Rhodamine WT is not easily adsorbed by clays and other minerals, and few substances interfere at its emission wavelength. In the field test, 1320 cc of dye was injected into a stream above a sink. Streamflow was calculated from dilution measurements above the sink and below a spring. The dye recovery at the spring was 98%, proving that the sink and spring are directly connected. The same technique can be used in more complex cases. (Knapp-USGS)
W70-00676

GROUNDWATER RESOURCES OF THE ERIE-NIAGARA BASIN, NEW YORK,
Geological Survey, Albany, N.Y.
A. M. LaSala, Jr.
NY State Water Resources Comm Basin Planning Rep ENB-3, 1968. 114 p, 20 fig, 5 plate, 9 tab, 29 ref.

Descriptors: *Water resources, *Groundwater, *Surveys, *New York, Lake Erie, Hydrologic data, Data collections, Water wells, Aquifers, Water levels, Water quality, Water pollution, Groundwater movement, Induced infiltration, Water supply, Duration curves, Hydrographs.
Identifiers: Erie-Niagara Basin (NY).

The Erie-Niagara basin, New York, borders Lake Erie and the Niagara River and includes the principal part of their drainage basin in New York. The principal water-bearing formations in the area are glacial sand and gravel deposits; the Camillus Shale, which contains interbedded gypsum; a limestone aquifer unit consisting of the Onondaga Limestone, Akron Dolomite, and Bertie Limestone; and the Lockport Dolomite. A number of thick and permeable sand and gravel deposits lie in the valleys of the upland region and will yield supplies of 500 to 1,400 gpm to individual wells that are properly constructed. Average annual recharge to the sand and gravel deposits in the upland region ranges from about half a million to 4 mgd/sq mi. As the larger deposits are each several square miles in extent, the potential for development is large. To this potential should be added infiltration from streams that could be induced by pumping large quantities of groundwater. The quality of groundwater in the Appalachian Uplands is marked by a high hardness but generally not by other unfavorable characteristics. Shallow groundwater in carbonate rocks and sand and gravel deposits locally has been polluted by septic tank effluent. (Knapp-USGS)
W70-00687

2G. Water in Soils

FORCES ACTING UPON THE SOLID PHASE OF A POROUS MEDIUM,
Agricultural Research Service, Madison, Wis.
Petrus A. C. Raats.
J Appl Math and Phys, Vol 19, No 4, p 606-613, July 1968. 8 p, 10 ref.

Descriptors: *Porous media, *Flow, *Stress analysis, *Mathematical studies, Groundwater movement, Soil water movement, Darcy's law, Soil physical properties, Soil physics, Hydraulics.
Identifiers: Continuum theory of mixtures.

The forces acting on the solids phase of porous media in which fluid is flowing are analyzed mathematically using the continuum theory of mixtures. Porous media consisting of a solid phase and any number of fluid phases are considered. Some special cases discussed are Darcy's law, seepage force, and effective stress. (Knapp-USGS)
W70-00459

TRACTIONABILITY STUDY FOR THE LAOTIAN PANHANDLE,
Environmental Technical Applications Center (Air Force), Washington, D.C.
Thomas E. White.
USAF, Air Weather Service, ETAC Technical Note 69-5, July 1969. 46 p, 13 tab, 15 fig, 2 ref. Available from the Clearinghouse as USAF ETAC Tech Note 69-5, $3.00 in paper copy, $0.65 in microfiche. AD-691 006.

Descriptors: *Soil moisture.
Identifiers: *Tractionability, Laos.

This study provides percent frequency of various tractionability classes (Thornthwaite's method) for 12 stations in the Laotian Panhandle and one in S. Vietnam. The stations are along major road networks in the Laotian Panhandle. Data are presented in tabular and graphical form.
W70-00484

EARTHFLOW OCCURRENCE DURING HIGH INTENSITY RAINFALL IN EASTERN OTAGO (NEW ZEALAND),
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 02B.
W70-00647

ERODIBILITY OF SAND-CLAY MIXTURES AS EVALUATED BY A WATER JET,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 02J.
W70-00724

PHYSICAL PROPERTIES OF PEATS AS RELATED TO DEGREE OF DECOMPOSITION,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
D. H. Boelter.
Soil Sci Soc Amer Proc 33 (4) July-Aug 1969, p 606-609.

Descriptors: *Peat, *Organic soils, *Soil density, *Soil water, *Hydraulic conductivity, Bogs, Minnesota, Soil physical property, Soil moisture, Soil water movement, Hydrologic properties, Saturated flow, Retention, Porosity.
Identifiers: *Fiber content, Degree of decomposition, *Histosols, Sapric peat, Hemic peat, Fibric peat.

Important physical characteristics, such as water retention, water yield coefficient, and hydraulic conductivity, vary greatly for representative northern Minnesota peat materials. The differences are related to the degree of decomposition, which largely determines the porosity and pore size distribution. Fiber content (>0.1 mm) and bulk density are properties often measured to indicate the degree of decomposition of peat materials and are criteria used to distinguish fibric, hemic and sapric peat types. Regression analyses showed a curvilinear relationship of water contents at saturation, 5 mbar, 0.1 bar, and 15 bar suctions, to fiber content (>0.1 mm) and bulk density with coefficients of multiple determination (R sq) ranging

from .66 to .88. Regression analyses of the logarithm of hydraulic conductivity on fiber content (>0.1 mm) and bulk density indicate a linear relationship (r sq= .54), although not as great due to the variability of hydraulic conductivity. Thus the classification of peat materials and organic soils based primarily on degreee of decomposition as measured by fiber content and vulk density would relate significant information about their physical characteristics.
W70-00761

2H. Lakes

AN ORIENTATION STUDY OF THE URANIUM DISTRIBUTION IN LAKE WATERS, BEAVERLODGE DISTRICT, SASKATCHEWAN,
Eldorado Mining and Refining Ltd., Montreal (Quebec).
John A. MacDonald.
Quart Colo School of Mines, Int Geochem Explor Symp, Vol 64, No 1, p 357-376, Jan 1969. 20 p, 9 fig, 2 tab, 15 ref.

Descriptors: *Uranium radioisotopes, *Lakes, *Surface waters, Chemical analysis, Bicarbonates, Conductivity, Seasonal, Spring, Temperature, Solubility, Geology, Topography, Mapping, Analytical techniques, Drainage, Statistical methods.
Identifiers: *Canada, *Saskatchewan, Geochemical prospecting.

Surface waters of the Beaverlodge uranium district of Saskatchewan were investigated for their mineral content. With the exception of the spring breakup period, there is no significant variation in the uranium content of lake water which can be attributed to seasonal temperature changes or precipitation. Correlation studies show an increase in specific conductance of lake water in the vicinity of mineralized areas. Lake water assays, in general, show that the Beaverlodge uranium district is delineated by an analytical plateau of 0.9 ppb U, approximately twice the regional background value of 0.4 ppb. Numerous high concentrations occurring within the background plateau levels define zones of pitchblende mineralization. (Gabriel-USGS)
W70-00423

URANIUM IN LAKE WATER FROM THE KAIPOKOK REGION, LABRADOR,
British Newfoundland Exploration Ltd.
W. T. Meyer.
Quart Colo School of Mines, Int Geochem Explor Symp, Vol 64, No 1, p 377-394, Jan 1969. 18 p, 13 fig, 3 ref.

Descriptors: *Lakes, *Water chemistry, *Uranium radioisotopes, *Trace elements, *Arctic, Exploration, Mapping, Glaciation, Ice, Statistical methods, Geophysics, Gamma rays, Streamflow, Sampling, Organic matter, Temperature, Carbonates.
Identifiers: *Canada, Labrador, *Geochemical prospecting.

The shallow lakes of glacial origin located in the Kaipokok region of Labrador were investigated for their uranium content by using a gamma-ray spectrometer flown by fixed-wing and helicopter systems and the U.S. Geological Survey technique based on the evaporation of 10-milliliter samples of lake waters. Lake water surveys for uranium are a significant aid to airborne exploration in this region of Labrador. Ideally, sampling should take place in the late fall and attention should be given to the effect of the biochemical cycle of uranium and especially to the contribution of uranium by swamp erosion. Because of the low cost of lake water surveys, this method could be used as a preliminary step before selecting areas to be flown using more expensive geophysical surveys. (Gabriel-USGS)
W70-00424

WATER-RELATED RESEARCH FOR THE GREAT LAKES REGION,
Michigan Univ., Ann Arbor. Dept. of Conservation; and Michigan Univ., Ann Arbor. Inst. of Science and Technology.
Spenser W. Havlick, and James T. Wilson.
EOS, Trans Amer Geophys Union, Vol 50, No 8, p 492-494, Aug 1969. 3 p.

Descriptors: *Research and development, *Water management (Applied), *Great Lakes, *Water resources development, Water quality, Systems analysis, Model studies, Economics, Data collections, Data storage and retrieval, Regional analysis, Data processing.
Identifiers: *Great Lakes region.

Coordinated study of water resources management in the Great Lakes by using systems analysis is recommended. The Great Lakes Basin Commission is suggested as a possible coordinating mechanism for water resources research between universities, research oriented organizations, and Federal and State agencies. A regional comprehensive model for the Great Lakes is not feasible at this time. Development of subsystem models is recommended for each geographic area of the Great Lakes region. The main areas of proposed research are: (1) water quantity and lake level models; (2) water quality models; and (3) economic growth models. There is also need for coordination of information retrieval, data storage, and data collection. An appraisal of the water management decisions is also recommended. (Carstea-USGS)
W70-00433

ECOLOGICAL FACTORS AND THE DISTRIBUTION OF CLADOPHORA GLOMERATA IN THE GREAT LAKES,
Wisconsin Univ., Milwaukee. Dept. of Botany.
For primary bibliographic entry see Field 05C.
W70-00667

COMPARATIVE ECOLOGY OF SANDSPIT PONDS,
Oberlin Coll., Ohio. Dept. of Biology.
For primary bibliographic entry see Field 02L.
W70-00671

OBSERVATIONS ON DEEPWATER PLANTS IN LAKE TAHOE, CALIFORNIA AND NEVADA,
Nevada Fish and Game Dept., Reno; and California State Dept. of Fish and Game, Sacramento. Inland Fisheries Branch.
Ted C. Frantz, and Almo J. Cordone.
Ecology, Vol 48, No 5, p 709-714, 1967. 3 fig, 3 tab, 17 ref.

Descriptors: *Deep water, *Lakes, *Plants, *California, *Nevada, Depth, Algae, Mosses, Chara, Fish, Limnology, Lake trout, Crayfish, Stoneflies, Snails, Ecology, Eutrophication, Domestic wastes, Shallow water, Chlorophyta, Chrysophyta, Cyanophyta, Sampling, Density, Light, Mud, Silts, Sands, Gravels, Sediments, Water pollution sources.
Identifiers: *Lake Tahoe (Calif-Nev), Hydrophytes, Liverworts, Morphometry, Pacifastacus leniusculus, Anacharis canadensis, Myriophyllum, Potamogeton crispus, Microspora wittrockii, Spirogyra, Xanthophyceae, Myxophyceae, Salvelinus namaycush, Substrate type.

Aquatic studies of Lake Tahoe have disclosed a remarkable plant zonation. With surface area not unusually large, it has maximum depth of 1645 feet, mean depth of 1027 feet. Deepwater macroscopic hydrophytes in Lake Tahoe, found to depths of 500 feet, consisted of algae, mosses, and liverworts. Most were concentrated at depths of 200-350 feet. Only Chara occasionally invades areas shallow as 20 feet; other deepwater hydrophytes are restricted to depths below 50 feet. The list of identified species, probably incomplete, includes six algae, ten mosses, and two liverworts. Although light transmission probably controls maximum depth of plant occurrence, factors limiting inshore distribution are less clear. Substrate type at lake's south end seems to control shoreward extension of plants. These deepwater plant beds are not only unusual scientific interest but appear important in the life history of Tahoe's major game fish, the lake trout, whose maximum concentration coincides with these plant zones; plants apparently provide shelter for crayfish, nongame fishes, and small lake trout. Longterm research on ecology of these deepwater hydrophyte communities is needed. Lake Tahoe is threatened with eutrophication from domestic wastes. (Jones-Wisconsin)
W70-00711

VERTICAL DISTRIBUTION OF PHOSPHORUS IN LINSLEY POND MUD,
Duke Univ., Durham N.C. Dept. of Zoology.
D. A. Livingstone, and J. C. Boykin.
Limnology and Oceanography, Vol 7, p 57-62, Jan 1962. 4 fig, 20 ref.

Descriptors: *Phosphorus, *Sorption, *Lake soils, Cycling nutrients, Bacteria, Lakes, Sediments, Ion exchange, Iron compounds.
Identifiers: *Linsley Pond (Conn), *Sediments (Mineral fraction), Seston, Einsele sorption isotherm, Diagenetic changes, Gyttja, Aluminum compounds, Hydroxyphosphates, Specific conductance.

Nitric-perchloric acid digestion disclosed large quantities of phosphorus (P) in the basal third of the sediment consisting largely of mineral particles. The low solubility of sedimentary phosphates, as shown by water and hydrochloric acid (0.1 Normal) extractions, suggested existence of sorption reactions of the element with the mineral fraction of the lake mud. Under conditions in lake soils, fixation of P in the form of apatite or iron and aluminum hydroxyphosphates is not feasible and the causes for the conversion of P into slowly soluble form was not disclosed. The ratio of bound P to inorganic material of different texture suggested a possibility of sorption on the surface of mineral particles. Regardless of the nature of reactions, the productivity of the lake is inversely proportional to the fixation capacity of the sediment and directly proportional to the total ionic activity of the water. (Wilde-Wisconsin)
W70-00712

COMPUTATION OF THE COMPONENTS OF THE THERMAL BALANCE OF PLANNED RESERVOIRS,
For primary bibliographic entry see Field 02D.
W70-00744

2I. Water in Plants

A LIMNOLOGICAL STUDY OF A TENNESSEE COLD SPRINGBROOK,
Tennessee Rechnological Univ., Cookeville. Dept. of Biology.
Michele S. Stern, and Daniel H. Stern.
The Amer Midland Natur, Vol 82, No 1, p 62-82, July 1969. 21 p, 3 fig, 4 tab, 52 ref.

Descriptors: *Limnology, *Springs, *Tennessee, Invertebrates, Seasonal, Forests, Animal population, Algae, Insects, Analytical techniques, Chemical analysis, Rainfall, Geology, Currents (Water), Calcium, Carbon, Nitrogen, Silica, Water temperature, Biota.
Identifiers: Springbrook limnology, Putnam County (Tenn).

A one-year limnological investigation was conducted on a small springbrook in Putman County, Tennessee to evaluate the components of invertebrate biocoenoses, to record the population fluxes and factors affecting abundance, and to determine interaction between members of the communities. Study of 59 taxa of invertebrates shows their greatest abundance in February and lowest in July. It is assumed that the surrounding

deciduous forest has the greatest effect on species composition and abundance of the fauna of the springbrook. (Gabriel-USGS)
W70-00672

THE FOREST VEGETATION OF THE BRULE RIVER BASIN, WISCONSIN, TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior.
Donald W. Davidson.
Paper presented before Minnesota Academy of Science, University of Minnesota, Duluth, May 3, 1969. OWRR Project A-023-WIS.

Descriptors: *Ecology, *Forest, *Vegetation, *Trees, Conservation.
Identifiers: *Northern Wisconsin, *Brule River basin, *Saplings.

Under contract with the Water Resources Center, University of Wisconsin, Madison, and as part of an interdisciplinary study of the ecology of the Brule River Basin, northern Wisconsin, during the summer of 1968 a survey was made of 20 stands of relatively undisturbed forest vegetation, distributed uniformly over the Brule River Basin. In each stand, 20 points were sampled by the Point-centered Quarter Method. Stems 3.96 inches diameter at breast height and over were classed as trees - those less than 3.95 inches d.b.h. were classed as saplings. Seventeen upland stands were sampled, and were dominated by the following leading dominant tree species: Quercus rubra, 5 stands; Populus tremuloides, 4; Populus grandidentata, 2; Pinus banksiana, 2; Abies balsamea, 2; Acer rubrum, 1; and Acer saccharum, 1. Three lowland stands were sampled, and were dominated by: Picea mariana, 1; Thuja occidentalis, 1; and Fraxinus nigra, 1. Curtis (1959 - The Vegetation of Wisconsin) describes three principal vegetation types for the area; (1) Northern forest - xeric; (2) Northern forest - lowland; (3) Boreal forest. These three types have distinct representatives in the stands studied thus far. The remaining stands are various successional stages of the other forest communities described. The vegetation of the Brule Basin has been much disturbed, particularly by cutting for lumber and pulp, so that most of the present vegetation can be said to be recovering from previous disturbance. (Dickas-Wisconsin State Univ)
W70-00765

2J. Erosion and Sedimentation

THE USE OF RADON-222 IN SURFACE WATERS IN GEOCHEMICAL PROSPECTING FOR URANIUM,
Geological Survey of Canada, Ottawa (Ontario).
Willy Dyck, and A. Y. Smith.
Quart Colo School of Mines, Int Geochem Explor Symp, Vol 64, No 1, p 223-236, Jan 1969. 14 p, 6 fig, 20 ref.

Descriptors: *Radioactivity techniques, *Uranium radioisotopes, Geochemistry, *Exploration, Sampling, Mine waters, Water chemistry, Surface waters, Ice, Lakes, Streams, Geology, Mapping, Statistical methods, Temperature.
Identifiers: *Canada, *Geochemical prospecting, Uranium.

As part of a geochemical prospecting study of uranium, a feasibility test of the use of radon-222 in surface waters was carried out during the latter part of 1967. The radon-222 and uranium contents of some 150 water samples from 140 sample sites in the Bancroft, Ontario, and Ottawa-Hull districts were found to vary from 0 to 2,200 pc/l and 0 to 47 ppb, respectively. A difference was observed between the radon content of lakes and ponds (0 to 262 pc/l, with some of the higher values being near uranium mining operations) and that of creeks and streams (0 to 2,200 pc/l). No such variations was noted for uranium. Although the correlation between radon and uranium values in the waters was marginal, the results indicated a gross areal correlation between radon or uranium content of surface waters and uraniferous areas. Spot measurements in winter found that radon levels in lake waters under the ice increase as expected but remain more or less constant in creeks. Uranium levels, on the other hand, remain more or less constant in lakes but decrease noticeably in creeks. The low cost and simplicity of the radon method suggest considerable potential as a preliminary reconnaissance geochemical prospecting method. (Gabriel-USGS)
W70-00421

INFLUENCE OF VARIATIONS IN SECONDARY ENVIRONMENT ON THE METAL CONTENT OF DRAINAGE SEDIMENTS,
Amax Exploration, Inc., Vancouver (British Columbia); and Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
R. F. Horsnail, I. Nichol, and J. S. Webb.
Quart Colo School of Mines, Int Geochem Explor Symp, Vol 64, No 1, p 307-322, Jan 1969. 16 p, 9 fig, 1 tab, 12 ref.

Descriptors: *Geochemistry, *Drainage, *Metals, *Surface waters, Environmental effects, Chemical analysis, Spectroscopy, Trace elements, Iron, Copper, Manganese, Lead radioisotopes, Zinc radioisotopes, Geology, Glacial soils, Rainfall, Soils.
Identifiers: *England and Wales, *Geochemical prospecting.

Drainage sediment sampling of about 3000 sq mi located in England and Wales was carried out for the purpose of determining the contents of Ag, Bi, Co, Cr, Cu, Fe, Ga, Mn, Mo, Ni, Pb, Sn, Ti, and V, to be used in regional geochemical reconnaissance for useful minerals. The distribution of these metals in the samples is closely related to secondary environment, in particular to areas of high rainfall and poorly drained soils, and less related to either geology or mineralization. Such correlations are shown, to various degrees, by Mn, Fe, Co, As, Ni, and Zn. In contrast, Cr, Ga, Ti, and V show no variation with respect to surface environment. The enhancement of certain elements in the drainage sediments is caused by hydromorphic dispersion controlled by variations in the Eh and pH of the aqueous media of dispersion. (Gabriel-USGS)
W70-00422

NATURAL ORGANIC ACIDS IN THE TRANSPORTATION, DEPOSITION, AND CONCENTRATION OF GOLD,
Colorado School of Mines, Golden; and Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W70-00425

ON THE GEOCHEMISTRY OF UPPER PALEOZOIC AND LOWER MESOZOIC SEDIMENTS OF THE NORTHERN PART OF THE CISVERKHOYANSK TROUGH (RUSSIAN),
Akademiya Nauk SSSR. Institut Geologii.
For primary bibliographic entry see Field 02K.
W70-00429

DIRECT ILLUSTRATION OF ONE WAY SAND TRANSPORT BY TIDAL CURRENTS,
National Inst. of Oceanography, Wormley (England).
Robert H. Belderson, and Neil H. Kenyon.
J Sediment Petrol, Vol 39, No 3, p 1249-1250, Sept 1969. 2 p, 2 fig, 1 ref.

Descriptors: *Sediment transport, *Sand waves, *Remote sensing, *Underwater, Beaches, Beach erosion, Sands, Waves (Water), Currents (Water), Bed load, Tides.
Identifiers: Side-scan sonar.

Side scan Asdic (sonar) has revealed local sand streams originating from the wings of sand waves and from between rock barriers. These provide further proof of the direction of net sand transport by tidal currents in the Bristol Channel, England. (Knapp-USGS)
W70-00436

QUANTITATIVE STATISTICAL ANALYSES OF COLUMBIA RIVER SEDIMENT SAMPLES,
Washington Univ., Seattle. Dept. of Oceanography.
James C. Kelley, and John T. Whetten.
J Sediment Petrol, Vol 39, No 3, p 1167-1173, Sept 1969. 7 p, 5 fig, 14 ref. Contract No AT (45-1) - 1725 AEC, Grant No GP-3591 and GA-1297 NSF.

Descriptors: *Sedimentation, *Sedimentology, *Statistical methods, *Correlation analysis, Sediments, Columbia River, Chemical analysis, Mineralogy, Particle size, Trace elements, Clays, Reservoirs.
Identifiers: Columbia River sediments, Multivariate statistical analysis.

Sediment samples from the Columbia River were analyzed for four variable sets: bulk chemistry, trace element chemistry, bulk mineralogy, and heavy mineral content. The variable sets were analyzed by discriminant function analysis and factor analysis to determine the relationships between samples in Columbia River reservoirs as reflected in their distribution in the variable space. Other statistical studies were made to determine the relationships among the variables and changes in the variables related to position in the river and grain size. The distribution of the samples in the variable space indicates changes in the sediment which can be related to changing source areas. (Knapp-USGS)
W70-00438

DEPOSITION OF CLASTIC SEDIMENTS BY CLAMS,
Bureau of Reclamation, Sacramento, Calif.
Nikola P. Prokopovich.
J Sediment Petrol, Vol 39, No 3, p 891-901, Sept 1969. 11 p, 11 fig, 2 tab, 10 ref.

Descriptors: *Deposition (Sediments), *Clams, *Filtration, Suspended load, Sedimentation rates, Sedimentation, Turbidity.
Identifiers: Biological deposition (Sediments).

The role of clams and other 'filter feeders' in sedimentation probably far exceeds the generally recognized accumulation of their skeletal remnants. In the course of their feeding, these organisms constantly remove suspended inorganic and organic particles from water, combine them with organic binder, and deposit them as excreta. The 'sticky' excreta (and shells) trap sand and other particles and contribute to sedimentation. The amount of clastic sediments deposited in this manner is significant, for example, in the 113-mile-long Delta-Mendota Canal in the western San Joaquin Valley, California. The sediments consist of 20-35% 'fines' which were probably precipitated as excreta, 35-50% sand, and 30% clamshells. Highly eutrophic, turbid deltaic water which is pumped into the canal supports an abundant, varied biota.Asiatic clams (Corbicula fluminea) are particularly numerous. The average number of live clams per sq ft of sediments is in the order of 1000. Laboratory pumping rate of a one-year Corbicula appears to be about 20 cc/hour. There is a general decline of clam infestation in the downstream direction, away from the Delta: In 1965-66, biomasses of Corbicula declined from about 140 (pool 1) to 25 (pool 18) tons per linear mile. Average sedimentation rates decline from about 292 cu yd/mi/yr in pools 1 through 5, to 9 cu yd/mi/yr in pools 15 through 19. Apparently smaller pumping-deposition of suspended particles by clams in downstream reaches results in correspondingly lower sedimentation rates. (Knapp-USGS)
W70-00442

ANATOMY OF A MODERN CARBONATE TIDAL-FLAT, ANDROS ISLAND, BAHAMAS,
Shell Development Co., Houston, Tex. Exploration and Production Research Div.; and Johns Hopkins Univ., Baltimore, Md. Dept. of Geology.
Eugene A. Shinn, R. Michael Lloyd, and R. N. Ginsburg.
J Sediment Petrol, Vol 39, No 3, p 1202-1228, Sept 1969. 27 p, 37 fig, 1 tab, 25 ref.

Descriptors: *Mud flats, *Tidal marshes, *Sedimentology, *Diagenesis, *Water chemistry, Geomorphology, Oxidation, Reduction (Chemical), Carbonate rocks, Limestones, Dolomite, Sedimentation, Chemical reactions, Chemical precipitation.
Identifiers: *Andros Island (Bahamas), Tidal flat.

The carbonate tidal-flat complex of northwestern Andros Island consists of 3 geomorphic areas: (1) adjacent marine belt, (2) channeled belt, and (3) marsh. The various sedimentary accumulations within these belts are controlled by tide levels. Three tidal zones are recognized: (1) subtidal zone, consisting of sediments deposited below low tide; (2) intertidal zone, consisting of sediments deposited between normal low and normal high tide; and (3) supratidal zone, consisting of sediments deposited above normal high tide but within the range of spring and storm tides. The complex may be thought of as a river delta turned 'inside out.' Most sediments that make up this delta have been transported via channel systems from the adjacent marine zone. Early diagenesis in the form of reduction, oxidation, dolomite formation, and carbonate cementation is also controlled by tide level. Strong odor of hydrogen sulfide in gray subtidal sediments suggests reduction, whereas the absence of this odor in the cream or light tan intertidal and supratidal sediments suggests oxidation. Dolomite formation and carbonate cementation are restricted to the distinctively laminated, algal-coated, and mud-cracked supratidal sediment. Stratigraphically, the channeled tidal-flat complex on northwest Andros Island is transgressive, whereas the nonchanneled flats on the southwestern coast are thought to be regressive. Alternation of transgressive and regressive tidal-flat sedimentation during subsidence or eustatic sea level rise could produce stratigraphic pinch-outs that may also become stratigraphic traps. (Knapp-USGS)
W70-00445

CHARACTERISTICS OF COLUMBIA RIVER SEDIMENT AND SEDIMENT TRANSPORT,
Washington Univ., Seattle. Dept. of Geology; and Washington Univ., Seattle. Dept. of Oceanology.
John T. Whetten, James C. Kelley, and Larry G. Hanson.
J Sediment Petrol, Vol 39, No 3, p 1149-1166, Sept 1969. 18 p, 10 fig, 5 tab, 34 ref. Contract No AT (45-1)-1725 AEC, Grant No GP-3591 and GA-1297 NSF.

Descriptors: *Sediments, *Columbia River, *Provenance, Suspended load, Bed load, Sediment yield, Sediment transport, Mineralogy, Erosion, Weathering, Particle size, Runoff, Scour, Reservoirs, Silting, Sand waves.
Identifiers: Columbia River sediments.

The mean particle size of sediment carried on the bed of the Columbia River increases downstream. The Snake River and other upstream tributaries contribute mostly fine sediment carried in suspension. Many downstream tributaries produce coarser sediment, which is carried largely in the bedload. Bedload is appreciable only in the lower portions of the river, and is a small percentage of the suspended load. Large migrating sand waves form the top surface of the bed. The distribution of sediment on some of the reservoir floors changes throughout the year. Sediment deposited during low discharges may be scoured from the reservoirs during periods of high discharge and transported downstream through the dams. The amount of sediment transported during a single flood may exceed that which is transported during an entire 'average' year. The mineral and chemical composition of Columbia River sediment obtained from reservoir floors suggests that the sediment particles have undergone relatively little chemical weathering. Chemically unstable mineral grains and lithic fragments abound. Quartz and elements considered relatively immobile during chemical weathering show no obvious enrichment in the sediment. The ratio of quartz to all 'unstable' constituents decreases downstream, whether the latter are taken individually or as a group. The upstream fine suspended sediment is derived ultimately from metamorphic, plutonic, and sedimentary rocks, and downstream bed load sediment is derived largely from the erosion of andesitic volcanic rocks and sediments. It is likely that these two sediment types remain more or less physically separated during transport and deposition. (Knapp-USGS)
W70-00446

GEOMORPHOLOGY OF A SAND RIDGE,
Chicago Univ., Ill. Dept. of the Geophysical Sciences.
J. Duncan Smith.
J Geol, Vol 77, No 1, p 39-55, Jan 1969. 17 p, 8 fig, 2 tab, 31 ref.

Descriptors: *Geomorphology, *Sand bars, *Currents (Water), Tides, Oceans, Islands, Dunes, Sand waves, Deposition (Sediments), Sedimentation, Erosion, Sedimentary structures.
Identifiers: Marthas Vineyard (Mass).

In the past, sand ridges and the associated marine sand waves have been studied extensively from a morphological point of view, but several important historical and dynamical problems associated with these features have been neglected. The present dynamical setting of a sand ridge (a shoal named Middle Ground) in Vineyard Sound, Massachusetts, is outlined and its origin is discussed. Sand waves cover the ridge. Those with amplitudes of 2 m are found to be completely rebuilt in half a tidal cycle, and those with amplitudes of 6 m are found to be significantly rebuilt over half a tidal cycle. Net movements of the sand waves are consistent with the counterclockwise net circulation of water around the ridge. Over the sand-wave crests the average maximum shear velocity is 4.5 cm/sec. Middle Ground is a body of sand, but its southwest extension (Lucas Shoal) is composed of glacial drift and veneered with sand. The geomorphological history of Middle Ground is traced from the deposition of a small Wisconsin recessional moraine, through a period of sea level rise during which wave erosion and longshore drift created an elongate submarine sand ridge, to a period of submergence during which waves modified the relic morainal feature and tidal currents reshaped both the submerged sand ridge and the relic moraine. The present morphology of the shoal is in dynamic equilibrium with the tidal current system, and large-scale morphological changes occur within a period of only a few years. (Knapp-USGS)
W70-00453

A RECONNAISSANCE OF STREAM SEDIMENT IN THE ERIE-NIAGARA BASIN, NEW YORK,
Geological Survey, Albany, N.Y.
R. J. Archer, and A. M. La Sala, Jr.
N Y State Water Resources Comm Basin Planning Rep ENB-5, 1968. 34 p, 7 fig, 4 tab, 9 ref.

Descriptors: *Sediment load, *New York, Suspended load, Bed load, Sediment yield, Streamflow, Erosion, Deposition (Sediments), Sedimentation, Lake Erie, Surveys, Sampling.
Identifiers: *Erie-Niagara Basin (NY).

A reconnaissance study of erosion and deposition of sediment in the Erie-Niagara basin indicates that the highest sediment yields, on the order of 1,000 tons/sq mi/yr, occur in streams that drain upland areas. In contrast, for example, from the lowland part of the Tonawanda Creek basin, the annual sediment yields are on the order of 100 tons/sq mi/yr. The estimated average annual sediment yields of streams in the basin range from 50 tons/sq mi for Little Tonawanda Creek at Linden, to 1,500 tons/sq mi for Cazenovia Creek at Ebenezer. These estimates are based on measured instantaneous sediment discharge at selected stream stations, the sediment loads of which ranged from 1,100 tons/yr for Little Tonawanda Creek at Linden to 610,000 tons/yr for Cattaraugus Creek at Gowanda. Peak suspended-sediment concentrations in the range of 2,600 to 5,300 ppm were observed at 3 stations in the Cattaraugus Creek basin, as well as at Buffalo Creek at Gardenville, Cazenovia Creek at Ebenezer, and Cayuga Creek near Lancaster. (Knapp-USGS)
W70-00466

GRAIN SIZE DISTRIBUTIONS AND DEPOSITIONAL PROCESSES,
Tulsa Univ., Okla.
Glenn S. Visher.
J Sediment Petrol, Vol 39, No 3, p 1074-1106, Sept 1969. 33 p, 21 fig, 1 tab, 52 ref. Grant No GA-997 and GA-1635 NSF.

Descriptors: *Deposition (Sediments), *Particle size, *Sands, Sedimentation, Statistical methods, Sedimentary petrology, Settling velocity, Sedimentation rates, Sediment transport, Sediment distribution, Sediments, Waves (Water), Suspended load, Bed load, Dunes, Winds.
Identifiers: Sedimentary textures, Sedimentary environment, Sedimentation dynamics.

Extensive textural study of both modern and ancient sands has provided the basis for a genetic interpretation of sand texture. Analysis is based on recognizing sub-populations within individual log-normal grain size distributions. Each log-normal sub-population may be related to a different mode of sediment transport and deposition, thus providing a measure of their importance in the genesis of a sand unit. The 3 modes of transport reflected are: (1) suspension; (2) saltation; and (3) surface creep or rolling. Each of these is developed as a separate sub-population within a grain size distribution. The number, amount, size-range, mixing, and sorting of these populations vary systematically in relation to provenance, sedimentary process, and sedimentary dynamics. The analysis of these parameters is the basis for determining the process-response characteristics of individual sand units. A number of processes are uniquely reflected in log-probability curves of grain size distribution of sands and sandstones. These include: (1) current; (2) swash and backwash; (3) wave; (4) tidal channel; (5) fallout from suspension; (6) turbidity current; and (7) aeolian dune. The combination of 2 or more of these processes also produce characteristics log-probability plots of ancient sands are directly comparable to those from modern sands. The principal limitation of this study is in comparing sands formed under comparable conditions and obtaining an independent determination of the processes of formation of ancient sands. (Knapp-USGS)
W70-00639

TIDAL FLAT EROSION BY ICE AT LA POCATIERE, ST. LAWRENCE ESTUARY,
Department of Fisheries and Forestry, Sillery (Quebec).
For primary bibliographic entry see Field 02L.
W70-00640

STRATIGRAPHY AND SEDIMENTOLOGY OF THE TERTIARY ROCKS OF THE MANDAMUS-DOVE RIVER AREA, NORTH CANTERBURY, NEW ZEALAND,
Pennsylvania Geological Survey, Harrisburg.
W. D. Sevon.
New Zeal J Geol and Geophys, Vol 12, No 1, p 283-309, May 1969. 27 p, 12 fig, 3 tab, 19 ref.

Descriptors: *Stratigraphy, *Sedimentology, *Sedimentary rocks, Tertiary period, Geology, Conglomerate rocks, Coals, Sands, Currents

(Water), Marine geology, Algae, Biomass, Volcanoes, River basins, Subsidence, Mapping, Analytical techniques, Fractures (Geology).
Identifiers: *New Zealand, *North Canterbury, Tertiary rocks.

A sedimentological study of the Tertiary sediments of the Mandamus-Dove River area in North Canterbury, New Zealand, indicates that fluvial conglomerates and coal were the first sediments deposited on a Cretaceous peneplain developed on greywackes of the Torlesse Group. Subsequent cross-bedded glauconitic sands were deposited by north-flowing longshore currents following marine transgression in the area. Rapid build-up of bedded tuffs produced by volcanic activity to the northeast diverted longshore current sedimentation from the area and permitted an environment suitable for the growth of an algal-crinoidal-bryozoan biostrome. Cessation of volcanic activity and continuing basin subsidence halted biostrome growth and allowed renewed deposition of detritus by marine currents. (Gabriel-USGS)
W70-00644

RECENT SEDIMENTATION AROUND NORTHERNMOST NEW ZEALAND,
New Zealand Oceanographic Inst., Wellington. Dept. of Scientific and Industrial Research.
C. P. Summerhayes.
New Zealand J Geol and Geophys, Vol 12, No 1, p 172-207, May 1969. 36 p, 15 fig, 3 tab, 35 ref.

Descriptors: *Sediments, *Sedimentation, *Marine geology, *Continental shelf, *Provenance, Sea level, Water level fluctuations, Glaciation, Detritus, Organic matter, Mineralogy, Basalts, Algae, Pleistocene epoch, Erosion, Mapping.
Identifiers: *New Zealand, Recent continental shelf sedimentation.

Relict shallow water sediments, formed during the post-glacial rise in sea level, cover the continental shelf off northernmost New Zealand. Supplies of detrital sediment are negligible and biogenic skeltal debris is the only sediment component being supplied to the sea floor at present in any large quantity. Glauconite is forming over much of the region and active sediment movement is restricted to the nearshore environment. Detrital non-carbonate sediment in the eastern part of the region has a southern basaltic provenance; that to west and north has an andesitic provenance and is derived in part from the south and in part locally. On Maria Ridge are rich calcarenites which are forming slowly at present. On banks on the Ridge sedimentation is extremely slow and thick algal growths have accumulated around basalt pebbles left on Pleistocene marine erosion terraces. (Gabriel-USGS)
W70-00645

EARTHFLOW OCCURRENCE DURING HIGH INTENSITY RAINFALL IN EASTERN OTAGO (NEW ZEALAND),
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 02B.
W70-00647

DIFFERENTIAL EQUATION OF THE EVOLUTION OF DELUVIAL SLOPES (IN RUSSIAN),
Kazan State Univ. (USSR). Dept. of Geography.
A. M. Trofimov, and Yu. P. Perevedentsev.
Vestnik Moskov Univ, Ser 5, Geogr, No 4, p 90-94, July-Aug 1969. 5 p.

Descriptors: *Geomorphology, *Mathematical studies, *Alluvium, *Slopes, *Erosion, Sedimentation, Profiles, Velocity, Deformation, Soil mechanics, Mathematical models, Geologic control, Land forming, Terrain analysis, Topography.
Identifiers: Deluvial slopes.

After briefly reviewing the contributions made by Strahler, Culling, Devdariani, Sheidegger, and others in the analytical studies of the evolution of deluvial slopes, a new analytical expression for the evaluation of a slope profile was proposed. This analytical expression gives the height of any profile point as a function of the horizontal distance and two empirical constants. In the final equation, the initial slope form is of considerable significance. (Gabriel-USGS)
W70-00648

CALCULATION OF SEDIMENT BALANCE OF THE LITTORAL ZONE (IN RUSSIAN),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02L.
W70-00649

ENVIRONMENTALLY SIGNIFICANT SEDIMENTOLOGIC CHARACTERISTICS OF BEACH SANDS,
Geological Survey of New Zealand, Christchurch. Sedimentation Lab.
For primary bibliographic entry see Field 02L.
W70-00650

RELATIONSHIPS BETWEEN GRAIN SIZE, SIZE-SORTING, AND FORESHORE SLOPE ON MIXED SAND-SHINGLE BEACHES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 02L.
W70-00651

SEDIMENTOLOGY OF THE WAITEMATA GROUP IN THE STANLEY POINT-DEVONPORT AREA, AUCKLAND, NEW ZEALAND,
Australian National Univ., Canberra. Dept. of Geology.
Brian G. Jones.
New Zeal J, Geol and Geophys, Vol 12, No 1, p 215-247, May 1969. 33 p, 16 fig, 2 tab, 21 ref.

Descriptors: *Sedimentation, *Sedimentology, *Stratigraphy, Sandstones, Silts, Currents (Water), Petrology, Model studies, Mapping, Structural geology, Scour, Petrography, Mineralogy, Analytical techniques, Detritus, Plankton, Diagenesis, Plants, Geology.
Identifiers: *New Zealand, *Auckland, Waitemata group.

A stratigraphic column shows the alternating sequence of sandstones and siltstones of the Lower Miocene Waitemata turbidite sediments, New Zealand. Descriptions of the sedimentary features, current direction indicators, grain size analyses, petrology, and trace fossils are given especially with regard to their use as possible correlation factors. The use of a model relating current direction variation within an expanding lobate turbidity current is discussed, together with its application for determining axial flow direction of the turbidity current and the direction of thickening of the turbidite sandstone. It is concluded that the best possible method of correlating the uniform sequence of unfossiliferous sediments available at present is by means of close-spaced detailed stratigraphic columns together with graphs of sandstone-siltstone ratio and bed thickness variations with respect to stratigraphic height. (Gabriel-USGS)
W70-00652

SEDIMENTARY FEATURES AND PENECONTEMPORANEOUS SLUMPING IN THE WAITEMATA GROUP, WHANGAPARAOA PENINSUAL, NORTH AUCKLAND, NEW ZEALAND,
Auckland Univ. (New Zealand). Dept. of Geology
M. R. Gregory.
New Zeal J Geol and Geophys, Vol 12, No 1, p 248-282, May 1969. 35 p, 22 fig, 45 ref.

Descriptors: *Sedimentology, *Slope stability, *Turbidity currents, *Sedimentary structures, Detritus, Marine geology, Mapping, Currents (Water), Structural geology, Sandstones, Folds (Geology), Estuaries, Faults (Geology).
Identifiers: *New Zealand, *Auckland, Waitemata Group, Sedimentary features.

Rocks belonging to a turbidite facies of the Lower Miocene Waitemata Group are exposed extensively about Whangaparaoa Peninsula, New Zealand. Interbedded with this sequence are a number of thick, distinctive, volcaniclastic grits believed to have been emplaced by submarine lahars. These sediments accumulated towards the axial parts of a marine basin within a continental borderland. The turbidites were deposited by predominant southeast-flowing currents. Directions of weak bottom traction currents were more variable. Deformation and contortion of strata occur on a grand scale and are attributed to the penecontemporaneous slumping of poorly consolidated sediments in response to tilting of the sea floor. Injection of clastic dikes accompanied later stages of movement in slumped sequences. Evidence suggests that one great slump sheet extends over a distance of at least 10 miles from near Red Beach in the west to Whangaparaoa Head and possibly Tiritiri Matangi in the east. (Gabriel-USGS)
W70-00653

OPTICAL METHOD FOR DETERMINING PARTICLE SIZES OF COARSE SEDIMENT,
Geological Survey, Washington, D.C.
John R. Ritter, and Edward J. Helley.
Geol Surv Prelim Rep Tech Water-Resources Invest, Book 5, Chapter C3, 1969. 33 p, 11 fig, 8 tab, 8 ref.

Descriptors: *Analytical techniques, *Particle size, *Sediments, *Instrumentation, Volumetric analysis, Photography, Streambeds, Gravels, Sands, Computer programs.
Identifiers: *Optical methods, Particle-size analyzer.

Although the volumetric analysis of sandy bed material with the particle-size analyzer does not agree closely with analysis by the standard sieving technique, the volumetric analysis is better for gravel and coarser bed material than the Wolman areal method of analysis. Because of the speed with which the analysis can be made and the quantity of material used in the volumetric analysis, this method appears to be the best available for gravel. Furthermore, modern techniques of rapid data processing are applicable to the volumetric method of analysis. A computer program for processing particle-size data by the volumetric method has been written and used successfully. (Carstea-USGS)
W70-00655

AN INVESTIGATION OF THE RELATIONSHIPS BETWEEN LANDSCAPE-GEOMORPHOLOGICAL FACTORS AND SEDIMENT RUNOFF OF THE RIVERS OF THE WESTERN TRANSCAUCASUS (IN RUSSIAN),
Moscow State Univ. (USSR).
L. F. Litvin.
Russian text with English summary. Vestnik Moskov Univ, Ser 5, Geogr, No 4, p 60-64, July-Aug 1969. 5 p, 4 fig.

Descriptors: *Sediment transport, *Streamflow, *Watersheds (Basins), *Geomorphology, Erosion, Slopes, Estuaries, Altitude, Geology, Sediment load, Vegetation effects, Weathering, Precipitation (Atmospheric).
Identifiers: *USSR, Transcaucasus.

A relationship between the total river transport and geomorphological parameters of river watersheds were investigated using hydrogeological data recorded at the three rivers of the Western Transcaucasus. The geomorphological parameters were assumed to be atmospheric precipitation, rock lithology, average watershed altitude, and stream slope patterns. High altitude zones and rock lithology are the most significant factors in sediment transport capacity of a river from the headwater to the mouth. (Gabriel-USGS)
W70-00656

OFF-SHORE SEDIMENTS, NORTH-WEST NELSON, SOUTH ISLAND, NEW ZEALAND,
New Zealand Oceanographic Inst., Wellington. Dept. of Scientific and Industrial Research.
For primary bibliographic entry see Field 02L.
W70-00660

THE APPEARANCE AND ORIGIN OF COLOURS IN MUDDY MARINE SEDIMENTS AROUND NEW ZEALAND,
New Zealand Oceanographic Inst., Wellington. Dept. of Scientific and Industrial Research.
For primary bibliographic entry see Field 02L.
W70-00661

DIAGENESIS, CHEMICAL SEDIMENTS, AND THE MIXING OF NATURAL WATERS,
Colorado Univ., Boulder. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02K.
W70-00674

ERODIBILITY OF SAND-CLAY MIXTURES AS EVALUATED BY A WATER JET,
Purdue Univ., Lafayette, Ind.
R. N. Rhasin, C. W. Lovell, Jr., and G. H. Toebes.
Available from the Clearinghouse as PB-187 272, $3.00 in paper copy, $0.65 in microfiche. Purdue University Water Resources Research Center Technical Report No 8, June 1969. 207 p, 42 fig, 31 tab, 99 ref. OWRR Project A-003-IND.

Descriptors: *Erosion control, Geomorphology, Clay, Graded, Stream stability, Cohesive soil, Particle size, Sand, Cohesionless soils, Soil stabilization, Abrasion.
Identifiers: *Erodibility, Water jet, Jet velocity.

Laboratory produced soil samples were subjected to erosion by means of 1/4 in. and 3/8 in. diam. submerged water jets. Special care was taken to control all variables that could effect the soil system behavior. The influence on erosion of the sample mixing and curing procedures, the grain size distribution and the ratio of constituent materials, including water content, was given attention. Samples were made from commercial clay (grundite) mixed with one or two grades of Ottawa Sand. Compaction pressures were 2.0 psi. Both the reate of weight loss due to erosion and undrained shear strength (using a laboratory vane) were determined. Obtained relationships between all named variables has been presented in both graphical and analytical form.
W70-00724

2K. Chemical Processes

INFLUENCE OF VARIATIONS IN SECONDARY ENVIRONMENT ON THE METAL CONTENT OF DRAINAGE SEDIMENTS,
Amax Exploration, Inc., Vancouver (British Columbia); and Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
For primary bibliographic entry see Field 02J.
W70-00422

URANIUM IN LAKE WATER FROM THE KAIPOKOK REGION, LABRADOR,
British Newfoundland Exploration Ltd.
For primary bibliographic entry see Field 02H.
W70-00424

NATURAL ORGANIC ACIDS IN THE TRANSPORTATION, DEPOSITION, AND CONCENTRATION OF GOLD,
Colorado School of Mines, Golden; and Geological Survey, Denver, Colo.
H. Ling Ong, and Vernon E. Swanson.
Quart Colo School of Mines, Int Geochem Explor Symp, Vol 64, No 1, p 395-425, Jan 1969. 31 p, 7 fig, 6 tab, 67 ref. Grant No 9300-146-67 (USGS).

Descriptors: *Gold, *Organic acids, *Streamflow, Deposition (Sediments), *Transportation, Water chemistry, Chlorides, Carbonates, Equilibrium, Lakes, Peat, Sulfates, Hydrogen, Ions, Analytical techniques, Carbon, Oxygen, Nitrogen, Colloids, Coagulation.
Identifiers: Gold compounds, Geochemical prospecting.

Geochemistry of gold in natural waters was investigated by using experimental studies and the results of earlier publications. Organic concentrations in the range of 3 to 30 ppm have the capacity to reduce gold chloride solutions to negatively-charged colloids of metallic gold. For the 30 ppm organic acid solutions, the reduction process is accomplished by the formation of a protective coating of hydrophobic gold sol making the gold very stable for a considerable time (at least 8 months). For smaller concentrations (3 ppm) of organic acid, the protective coating is not formed and the colloidal gold precipitates. In very acid solutions the presence of organic matter causes the reduction of gold chloride, and metallic gold of colloidal size is precipitated and intimately associated with the organic matter. In slightly acid to basic waters, that is in the general range of natural waters, gold can only be transported as stable organic-protected colloids. These organic-protected gold colloids are precipitated when they enter a different chemical environment (sea or brackish water) or when they enter an acid environment. (Gabriel-USGS)
W70-00425

OXIDIZING-REDUCING CONDITIONS OF THE 'NAFTUSIA' MINERAL WATERS FORMATION (RUSSIAN),
A. I. Germanov, I. P. Paseka, and P. M. Pylat.
Sovetskaya Geologiya, SSSR, Issue No 6, p 139-146, 1969. 8 p, 3 fig, 2 tab, 8 ref.

Descriptors: *Mineral water, *Oxidation, *Reduction (Chemical), *Groundwater, *Groundwater movement, *Springs, Organic matter, Water analysis, Carbonates, Calcium, Magnesium, Geologic mapping, Structural geology, Stratigraphy, Sediments, Geochemistry, Water temperature, Sulfates, Chlorine.
Identifiers: *USSR, Lvov, Ukraine.

Truskavets mineral spring in the Lvov area, Ukraine, was investigated on the basis of hydrological and hydrochemical data. Hydrodynamically the spring waters are associated with a small artesian groundwater basin located in one of the folds of a large anticline. The water-bearing zones are a sweet-water zone containing 0.7 to 0.9 gr/l of mineralized matter, a sodium, calcium-chlorine sulfate water zone containing 2.0 to 8.0 gr/l of mineralization, and a chloride-sodium zone of of high mineralization and salinity containing some hydrogen sulfide. Descriptions of the oxidation-reduction processes and the curative properties of the spring waters are also given. (Gabriel-USGS)
W70-00428

ON THE GEOCHEMISTRY OF UPPER PALEOZOIC AND LOWER MESOZOIC SEDIMENTS OF THE NORTHERN PART OF THE CISVERKHOYANSK TROUGH (RUSSIAN),
Akademiya Nauk SSSR. Institut Geologii.
A. F. Safronov.
Sovetskaya Geologiya, SSSR, Issue No 7, p 145-148, 1969. 4 p, 3 ref.

Descriptors: *Geochemistry, *Sediments, *Mesozoic era, *Paleozoic era, *Structural geology, Oil reservoirs, Gases, Organic matter, Carbon, Chemical analysis, Oxidation-reduction potential, Analytical techniques, Sulfur, Iron, Pyrite, Bituminous materials, Boreholes, Sands, Diagenesis.
Identifiers: *USSR, Verkhoyansk trough.

Sediments of the Cisverkhoyansk trough of northeastern Siberia were investigated on the basis of surface and borehole samplings for the evaluation of oxidation-reduction processes. The Upper Paleozoic and Lower Mesozoic sediments were developed in a weakly-oxidizing and strongly-reducing geochemical environment at depths of over 1500 m. It is conceivable that under optimal thermodynamical conditions these sediments could form hydrocarbons suitable for the development of gas and oil reservoirs. (Gabriel-USGS)
W70-00429

THORIUM-228 IN MARINE PLANKTON AND SEA-WATER,
Cape Town Univ. (South Africa). Dept of Physics, and Division of Sea Fisheries, Sea Point (South Africa).
R. D. Cherry, I. H. Gericke, and L. V. Shannon.
Earth and Planetary Sci Letters, Vol 6, No 6, pp 451-456, Sept 1969. 6 p, 1 fig, 1 tab, 24 ref.

Descriptors: *Radioisotopes, *Sea water, *Plankton, *Radiochemical analysis, Sampling, Tracers, Tracking techniques, Water chemistry.
Identifiers: *Thorium radioisotopes.

Data are given for thorium-228 in zooplankton, phytoplankton and sea water from seven different oceanographical water masses in the South Atlantic and around the Southern African coast. The levels in plankton are easily detectable. What appear to be real variations from one water mass to another were observed, and the possible utility of thorium-228 as a natural oceanographic tracer is noted. The levels in sea water are in general at or below the sensitivity level of the technique used, but for one set of samples a particularly high thorium-228 content was obtained. This set is from the Walvis Ridge area, and this region is particularly interesting in thorium and certain other trace elements. (Knapp-USGS)
W70-00434

OCEANIC CONCENTRATIONS OF RADIUM-228,
State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
Willard S. Moore.
Earth and Planetary Sci Letters, Vol 6, No 6, p 437-446, Sept 1969. 10 p, 5 fig, 3 tab, 10 ref. Grant AT (30-1)3629 (AEC).

Descriptors: *Water chemistry, *Sea water, *Radium radioisotopes, Mixing, Currents (Water), Water circulation, Tracers, Analytical techniques, Radiochemical analysis, Sampling.
Identifiers: Thorium radioisotopes.

This paper evaluates the worldwide oceanic distribution of Ra-228. Nearshore waters, especially waters from restricted bays and sounds, are very high in unsupported Ra-228. The concentrations decrease away from land. The Ra-228 content of surface waters bears a close correlation with the proximity to land. Samples from the Atlantic Ocean are higher than those from the Pacific Ocean. Apparently the source of Ra-228 in surface waters is diffusion from Th-232-bearing sediments in contact with these waters. Deep water samples collected less than 100 m from the sea floor have significant Ra-228 concentrations. Apparently Ra-228 is diffusing from deep-sea sediments as it is from nearshore sediments. Deep Pacific samples are generally lower than deep Atlantic samples. This may mean that Ra-228 released from Pacific sediments is mixed upward more rapidly, thereby decreasing the near-bottom concentrations. Intermediate water samples have less Ra-228 than either surface or bottom samples from the same area. These concentrations are near the lower limit of detection. Because the vertical mixing rate of the ocean is much greater than the mean life of Ra-228, little Ra-228 can penetrate into the intermediate ocean. (Knapp-USGS)
W70-00435

THE EXCHANGE OF HYDROGEN ISOTOPES BETWEEN ICE AND WATER IN TEMPERATURE GLACIERS,
Iceland Univ., Reykjavik. Science Inst.

Bragi Arnason.
Earth and Planetary Sci Letters, Vol 6, No 6, p 423-430, Sept 1969. 8 p, 3 fig, 1 tab, 17 ref.

Descriptors: *Water chemistry, *Glaciers, *Deuterium, Stable isotopes, Tritium, Tracers, Paleoclimatology, Mixing, Ice, Water, Melting, Freezing, Thermodynamics, Precipitation (Atmospheric).
Identifiers: Hydrogen isotopes, Isotope exchange, Temperate glaciers, Iceland.

Isotopic exchange between ice and water is found to take place in temperate glaciers. This exchange causes homogenization of deuterium in snow during summer thaws, together with a general increase in deuterium concentration. Ice in a temperate glacier is therefore more homogeneous and has a higher deuterium concentration than the precipitation on the glacier. The difference between the average deuterium concentration in ice and precipitation gives information about the runoff ratio. (Knapp-USGS)
W70-00439

HYDROLOGY OF SOUTH BONAIRE, N. A. - A ROCK SELECTIVE DOLOMITIZATION MODEL,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Geology.
For primary bibliographic entry see Field 02F.
W70-00441

EXPERIMENTAL DISSOLUTION OF CALCIUM, MAGNESIUM, AND STRONTIUM FROM RECENT BIOGENIC CARBONATES: A MODEL OF DIAGENESIS,
George Washington Univ., Washington, D.C.
Johannes H. Schroeder.
J Sediment Petrol, Vol 39, No 3, p 1057-1073, Sept 1969. 17 p, 11 fig, 2 tab, 65 ref.

Descriptors: *Diagenesis, *Carbonate rocks, *Water chemistry, *Solubility, Bioindicators, Paleoclimatology, Calcium, Magnesium, Trace elements, Carbonates, Thermodynamic behavior, Laboratory tests, Leaching.
Identifiers: Biogenic carbonate deposits.

Laboratory experiments at ordinary temperature and pressure for periods up to 240 days on recent biogenic carbonate materials showed that fresh water and sea water dissolve aragonite and magnesium calcite prior to mineralogical changes. The observed rates of dissolution of calcium, magnesium, and strontium indicate that these elements are incorporated in aragonite and magnesium calcite in more than one way (in lattice positions, absorbed in lattice interstices, or as inclusions). This suggests the presence of more than one mineral phase in the skeletal material studied; these phases differ in response to solution, in quantity, and probably in chemical composition. Calcium, magnesium, and strontium are dissolved in proportions different from those in the original solid. The experimentally established sequence of preference is Mg, Ca, Sr. Factors found to determine direction and degree of incongruency in dissolution include mineralogy (number, kind, and relative abundance of phases present), chemical composition, physiologic effects (taxonomy and non-taxonomy related), and chemical composition and volume of waters effective in dissolution. Incongruent dissolution determines abundance of ions derived from solids in the diagenetic environment and hence, ion availability for precipitation in cement and for inhibition or catalysis in inversion or cement precipitation. Because of incongruent dissolution Mg and Sr contents of shells are not dependable for paleo-environmental analysis. (Knapp-USGS)
W70-00444

ANATOMY OF A MODERN CARBONATE TIDAL-FLAT, ANDROS ISLAND, BAHAMAS,
Shell Development Co., Houston, Tex. Exploration and Production Research Div.; and Johns Hopkins Univ., Baltimore, Md. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W70-00445

RADIOMETRIC AND SPECTROPHOTOMETRIC DETERMINATION OF TRACE AMOUNTS OF SELENIUM USING 3, 3' - DIAMINOBENZIDINE AS THE INITIAL REAGENT,
Missouri Univ., Kansas City. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W70-00460

DETERMINATION OF PHENOXY ACID HERBICIDES IN WATER BY ELECTRON-CAPTURE AND MICROCOULOMETRIC GAS CHROMATOGRAPHY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05A.
W70-00473

IMPLICATIONS OF THE MINOR ELEMENT CONTENT OF SOME MAJOR STREAMS OF THE WORLD,
Geological Survey, Washington, D.C.
W. H. Durum, and Joseph Haffty.
Geochim et Cosmochim Acta, Vol 27, p 1-11, 1963. 11 p, 6 fig, 4 tab, 16 ref.

Descriptors: *Trace elements, *Rivers, *Surveys, Water quality, Water chemistry, Geochemistry, Data collections, Solutes, Runoff, Aqueous solutions.
Identifiers: Geochemical river surveys, Minor elements.

Of 15 or more minor elements in the world's principal river waters only aluminum, iron, manganese, barium and strontium range much over 100 micrograms/liter. Most minor elements range at or below 100 micrograms/liter and have median (or middle) values of 10 micrograms per liter or less. Significant areal differences in minor element content are found in the river waters. For example, Atlantic Coastal river waters in the aggregate are slightly more enriched in concentrations of silver, chromium, manganese, molybdenum, nickel, strontium, and titanium, and slightly deficient in barium and lithium when compared with median values for North America. Median values of ration Ba/Sr. Ni/Cr and Ni/Cu are reasonably consistent (within a factor of two) in principal drainage from North America. Noteworthy are consistent median rations of Ni/Cu for large rivers of United States, but the ratio tends to be slightly greater in global northern latitudes than in southern latitudes. Median values for aluminum, barium, copper, lead, molybdenum and silver in North American runoff are of the same order as published world averages for ocean water. Hydrologic and geochemical aspects of continental runoff are strongly implied in observations of minor element content of large rivers. Evidence to date is that median values of Ba/Sr ratios are relatively uniform in global river waters. There is real danger in over simplifying chemical systems in broad assessments of lower reaches of large drainage basins because individual hydrologic and chemical events upstream are largely obscured. (Knapp-USGS)
W70-00478

A NOTE ON THE DEPENDENCE BETWEEN THE CONCENTRATION OF CHLORIDE IONS AND THE RADIOACTIVITY OF EMANATION DISSOLVED IN MINERAL WATERS (IN POLISH),
Warsaw Univ. (Poland). Faculty of Geophysics.
For primary bibliographic entry see Field 05A.
W70-00668

SOME CHARACTERISTICS OF THE WATERS OF GEORGIAN MUD VOLCANOES (IN RUSSIAN),
Akademiya Nauk Azerbaidzhanskoi SSR, Baku. Institut Geologii.
M. F. Dzvelaya, and Ad. A. Aliyev.
Published in Russian with English and Georgian summaries. Soobshch Akad Nauk, Gruz SSR, Vol 54, No 1, p 121-124, Apr 1969. 4 p, 1 fig, 5 ref.

Descriptors: *Water chemistry, *Chemical properties, *Mudflows, *Volcanoes, Iron oxides, Mud, Carbonates, Chlorides, Alkaline water, Salinity, Mineral water, Sodium, Calcium, Potassium, Sulfates, Organic matter, Boron, Trace elements.
Identifiers: *Georgia SSR, Mud volcanoes.

The chemical composition of the waters of the mud volcanoes of Eastern Georgia, USSR, were investigated. Waters of the great majority of mud volcanoes are of the hydrocarbonaceous (sodium) type and of the chloride group. The waters of the Kila-Kuprinskiy mud volcano, however, are of a chlorine-calcium type, chloride group, and show deeper origin. The trace elements vary from 6.9-11.0 mg/l of iodine and 74.0 to 85 mg/l of boron in Kila-Kuprinskiy volcano, and 0.7 mg/l of iodine, 94.0 mg/l of bromine, and 16.0 mg/l of boron in the waters of Akhtal'skiy volcano. It is of interest to note that the presence of organic matter, boron, and iodine associated with an insignificant amount of sulfates in the waters of the mud volcanoes suggests some genetic association between the mud volcanoes and oil- and gas-bearing occurrences of Eastern Georgia. (Gabriel-USGS)
W70-00670

DIAGENESIS, CHEMICAL SEDIMENTS, AND THE MIXING OF NATURAL WATERS,
Colorado Univ., Boulder. Dept. of Geological Sciences.
Donald D. Runnells.
J Sediment Petrol, Vol 39, No 3, p 1188-1201, Sept 1969. 14 p, 7 fig, 1 tab, 83 ref.

Descriptors: *Chemical reactions, *Water chemistry, *Diagenesis, *Mixing, Solutes, Chemical precipitation, Aqueous solutions, Electrolytes, Ions, Ion exchange, Chemical degradation, Corrosion, Groundwater movement, Soil water movement, Leaching, Mineralogy.
Identifiers: Chemical sediments.

The chemical effects of mixing in the laboratory include changes in the concentration and electrical properties of a solution, shifts in homogeneous equilibria, and precipitation or dissolution of a solid phase. Similar chemical effects occur in nature as a result of the mixing of natural waters, and in some instances these may result in diagenesis. A simple classification yields 14 distinct categories of natural waters with 91 possible combinations of mixing of pairs of such waters. Examples are known of the precipitation of hydroxides and carbonates as a result of the mixing of chemically dissimilar surface waters. Because of the great variety of chemically dissimilar subsurface waters, plus the existence of potential fields which cause the movement of subsurface waters, mixing and diagenesis in the subsurface may be a common and significant geologic process. The solubility of rock forming minerals is a non-linear function of such independent variables as salinity, partial pressure of gases, temperature, and so on. The dissolution of calcium carbonate as a result of 'Mischungskorrosion' can be viewed in the light of the non-linearity of the solubility curve. Mixing of solutions which differ only in their content of dissolved electrolytes may cause either the precipitation or dissolution of rock-forming minerals. (Knapp-USGS)
W70-00674

BIOCHEMICAL OXYGEN DEMAND AND DEGRADATION OF LIGNIN IN NATURAL WATERS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Technical Services.
For primary bibliographic entry see Field 05B.
W70-00681

CHEMICAL QUALITY OF STREAMS IN THE ERIE-NIAGARA BASIN, NEW YORK,
Geological Survey, Albany, N.Y.
R. J. Archer, A. M. LaSala, Jr., and J. C. Kammerer.

NY State Water Resources Comm Basin Planning Rep ENB-4, 1968. 104 p, 18 fig, 1 plate, 24 tab, 24 ref, 2 append.

Descriptors: *Water quality, *Surface waters, *Groundwater, *Surveys, *New York, Water chemistry, Solutes, Hardness (Water), Water pollution, Data collections, Hydrologic data.
Identifiers: Erie-Niagara Basin (NY).

The streams in the 2,000-square-mile Erie-Niagara basin of western New York contain mainly a calcium bicarbonate type of water with a dissolved-solids content generally between 140 and 240 ppm. The dissolved-mineral content of shallow groundwater is the principal influence upon the chemical quality of the streams, except during and soon after periods of dilution by heavy precipitation or snowmelt. The average dissolved-mineral content of precipitation is about 35 ppm of dissolved solids, but substantially higher concentrations, as much as 327 ppm, have occurred. These high concentrations are attributed to industrial air pollution in the Buffalo area. Chemical analyses of more than 700 samples collected mainly during 1963 and 1964, including samples of precipitation and overland flow are compiled. Maps and graphs show significant regional and time variations in the natural water quality. (Knapp-USGS)
W70-00688

2L. Estuaries

ESTUARINE STUDIES IN UPPER GRAYS HARBOR, WASHINGTON,
Geological Survey, Washington, D.C.
Joseph P. Beverage, and Milton N. Swecker.
Geol Surv Water-Supply Pap 1873-B, 1969. 90 p, 55 fig, 8 tab, 39 ref.

Descriptors: *Estuaries, *Water quality, *Water resources, *Washington, Circulation, Tides, Currents (Water), Water pollution effects, Path of pollutants, Dissolved oxygen, Oxygen demand, Water pollution sources, Tracers, Dye releases.
Identifiers: *Grays Harbor (Wash), Water resources research.

Circulation patterns, water-quality conditions, and bottom material in upper Grays Harbor, Washington, were studied to improve water resource management. Salt water was found to intrude at least as far as Montesano, 28.4 nautical miles from the mouth of the harbor. Longitudinal salinity distributions were used to compute dispersion (diffusivity) coefficients ranging from 842 to 3,520 sq ft per second. These values were corroborated by half-tidal-cycle dye studies. The waters of the harbor were found to be well mixed after extended periods of low fresh-water flow but stratified at high flows. Velocity-time curves for the upper harbor are distorted from simple harmonic functions owing to channel geometry and frictional effects. Net separation distances between top and bottom water ranged from 1.65 nautical miles when fresh-water inflow was 610 cfs to 13.4 miles when inflow was 15,900 cfs. The cumulative mean age from integration of the fresh-water velocity equation was about twice that obtained from the salinity distribution. Carbon content was low upstream and downstream of the upper harbor area, and high in the Cow Point-Rennie Island reach. The high-carbon-content reach coincides with the general area of a dissolved-oxygen sag. At Cosmopolis, the daily minimum dissolved oxygen content correlated well with discharge and tidal range. The upper harbor was found to contain 250 million cubic feet less water than average during the critical low-flow period, on the basis of the frequency distribution of predicted tides. About 78,000 pounds of dissolved oxygen is thus available for oxidation of waste during summer. (Knapp-USGS)
W70-00419

THORIUM-228 IN MARINE PLANKTON AND SEA-WATER,
Cape Town Univ. (South Africa). Dept of Physics, and Division of Sea Fisheries, Sea Point (South Africa).
For primary bibliographic entry see Field 02K.
W70-00434

OCEANIC CONCENTRATIONS OF RADIUM-228,
State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
For primary bibliographic entry see Field 02K.
W70-00435

THE ROLE OF MARINE SCIENCES IN THE MULTIPLE USES OF THE COASTAL ZONE OF LAKE ERIE AND LAKE SUPERIOR,
National Planning Association, Washington, D.C. Center for Techno-Economic Studies.
Miller B. Spangler.
Available from Clearinghouse as PB 185 163 for $3 in paper copy, 65 cents in microfiche. Rep of Techno-Econ Studies Center, Nat Planning Ass, June 1969. 391 p, 7 fig, 10 tab, 8 append.

Descriptors: *Multiple-purpose projects, *Planning, *Great Lakes, *Water resources development, *Water pollution control, Lake Erie, Lake Superior, Water pollution treatment, Recreation, Industrial water, Municipal water, Navigation, Governments, Legislation, Water management (Applied).
Identifiers: Multiple shoreline uses (Great Lakes).

A study was made to identify measures in marine sciences which can be applied to the promoting of optimum use of the coastal zone of the Great Lakes. Lake Superior and Lake Erie were selected for study to illustrate the contrast of problems and opportunities in utilizing the waters and shoreline resources of the Great Lakes system. Lake Superior is the largest and deepest of the Great Lakes and with a few local exceptions is still basically of pristine character. Lake Erie by contrast, is the smallest and shallowest lake in the system, and with its intensively developed shoreline and hinterland has suffered probably the most extreme degradation of environmental quality. The analysis of these conditions has lead to the conclusion that the priority emphasis for action should be directed toward preservation of the essentially undeteriorated resources of Lake Superior, and to combating the further deterioration and restoration of the quality of resources of Lake Erie. A major conclusion of this study is that Lake Erie, far from being a 'dead Lake,' is capable of a significant degree of restoration of environmental quality if the sources of pollution entering Lake Erie are brought under effective control. Because of the relative shallowness of Lake Erie, the present rate of outflow into Lake Ontario discharges a total volume of water in only 2 1/2 yr equal to the volume of water contained in Lake Erie, which suggests that improvements in water quality could be achieved in a relatively few years. Recommendations are made to reinforce or to encourage reconsideration of essential actions leading to potentially new or expanded developments of coastal zone resources, particularly in those areas where regional, national, and international benefits may be forthcoming from a strengthened marine sciences program. (Knapp-USGS)
W70-00457

A DIVERSIFIED PROGRAM FOR THE STUDY OF SHALLOW WATER SEARCHING AND MAPPING TECHNIQUES,
Pennsylvania Univ., Philadelphia. Univ. Museum.
For primary bibliographic entry see Field 07B.
W70-00461

AN EXPERIMENTAL IN SITU DENSITOMETER,
Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
For primary bibliographic entry see Field 07B.
W70-00462

OPTICAL OCEANOGRAPHY,
Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.
For primary bibliographic entry see Field 07B.
W70-00464

ESTUARINE LAND OF NORTH CAROLINA: LEGAL ASPECTS OF OWNERSHIP, USE, AND CONTROL,
For primary bibliographic entry see Field 06E.
W70-00565

APPLICATION OF AN AIRBORNE PULSED LASER FOR NEAR SHORE BATHYMETRIC MEASUREMENTS,
Syracuse Univ. Research Corp., N.Y.
For primary bibliographic entry see Field 07B.
W70-00636

TIDAL FLAT EROSION BY ICE AT LA POCATIERE, ST. LAWRENCE ESTUARY,
Department of Fisheries and Forestry, Sillery (Quebec).
Jean-Claude Dionne.
J Sediment Petrol, Vol 39, No 3, p 1174-1181, Sept 1969. 8 p, 9 fig, 23 ref.

Descriptors: *Erosion, *Mud flats, *Ice, *Ice breakup, *Estuaries, Beach erosion, Bank erosion, Tidal marshes, Silts, Clays, Sedimentation, Sediment transport.
Identifiers: St. Lawrence estuary (Canada), Tidal flats.

The tidal flat areas of the Middle St. Lawrence Estuary are severely eroded by shore ice. Grooves parallel or perpendicular to the shoreline, measuring 30 to 80 cm wide, 20 to 35 cm deep, and 1500 to 2000 m long, and circular or subcircular basins up to 2 m in diameter and 20 to 40 cm deep are produced every spring by ice blocks that plow the surface and greatly disturb the sediments. (Knapp-USGS)
W70-00640

APPLICATION OF THE SPECTRAL ANALYSIS METHOD TO THE PRE-ESTIMATION OF TIDES (IN RUSSIAN),
Nguyen Ngoc Thuy.
Vestnik Moskov Univ, Ser 5, Geogr, No 4, p 118-121, July-Aug 1969. 4 p, 2 fig, 12 ref.

Descriptors: *Tides, *Mathematical studies, *Forecasting, Water level fluctuations, Sea level, Computers, Frequency analysis, Waves (Water), Velocity.
Identifiers: South China Sea, Spectral analysis.

The applicability of the spherical harmonics method to the study of tides of the South China Sea was investigated. Using a few sea-level observations and the auto-correlation technique on electronic computers, a spectral function of the tides of the South China Sea was obtained. The spectral function yields the predominant wave types, daily components, and energy. (Gabriel-USGS)
W70-00643

STRATIGRAPHY AND SEDIMENTOLOGY OF THE TERTIARY ROCKS OF THE MANDAMUS-DOVE RIVER AREA, NORTH CANTERBURY, NEW ZEALAND,
Pennsylvania Geological Survey, Harrisburg.
For primary bibliographic entry see Field 02J.
W70-00644

RECENT SEDIMENTATION AROUND NORTHERNMOST NEW ZEALAND,
New Zealand Oceanographic Inst., Wellington. Dept. of Scientific and Industrial Research.
For primary bibliographic entry see Field 02J.

W70-00645

THE PROPOSED SOLWAY FIRTH BARRAGES: A REVIEW OF THE GEOLOGICAL AND GEOTECHNICAL ASPECTS,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
For primary bibliographic entry see Field 04A.
W70-00646

CALCULATION OF SEDIMENT BALANCE OF THE LITTORAL ZONE (IN RUSSIAN),
Moscow State Univ. (USSR).
G. A. Saf'yanov.
Vestnik Moskov Univ, Ser 5, Geogr, No 4, p 121-122, July-Aug 1969. 2 p, 1 fig. Russian text with English summary.

Descriptors: *Sediment transport, *Sedimentation, *Littoral drift, Sedimentation rates, Gages, Mathematical studies, Surveys, Forecasting, Topography, Slopes, Sediment discharge.
Identifiers: Littoral zone, Sediment balance.

The sediment balance of a coastal section is determined by the difference between the sediment income of the section and its drifting outside the section. If a repeated measurement is made on the coastal section by fixed gage lines, it is possible to estimate the drift balance for the period between the two measurements. Drift balance is determined as an integral of the function describing changes of the relief (in cross section) along the water edge during the period between surveys. (Gabriel-USGS)
W70-00649

ENVIRONMENTALLY SIGNIFICANT SEDIMENTOLOGIC CHARACTERISTICS OF BEACH SANDS,
Geological Survey of New Zealand, Christchurch. Sedimentation Lab.
Peter B. Andrews, and G. J. Van der Lingen.
New Zeal J Geol and Geophys, Vol 12, No 1, p 119-137, May 1969. 19 p, 11 fig, 2 tab, 29 ref.

Descriptors: *Sediments, *Marine geology, *Beaches, *Sands, Slopes, Scour, Petrology, Stratigraphy, Statistical methods, Mapping, Detritus, Gravels, Frequency analysis, Texas.
Identifiers: New Zealand, Beach sands.

Comparative study of 5 South Island, New Zealand beaches and a beach on the central Texas coast suggests a short list of features that are diagnostic of the coastal beach. Beach sediments are clean (no mud matrix) and are very well to moderately well sorted. Foreshore strata occur as even, internally laminated, thin beds that dip seaward at low angles. The angle of dip is directly related to the slope of the foreshore surface, which in turn is largely dependent upon the mean size of the beach sediment; that is, the coarser the grain size the steeper the foreshore. Backshore strata occur as lense and slightly wedge-shaped internally laminated thin beds. Scour surfaces and cross-stratified lenses are characteristics. Dip of strata varies from 0 deg to 15 deg, and strata dip directly or obliquely landward. A transition zone (foreshore or above high tide level plus outer backshore) is characterized by mixed foreshore and backshore stratification, and some strata dip landward, others dip seaward. Many beaches furnish positively skewed distributions. It is concluded that skewness is not necessarily an environment-sensitive measure, and that skewness values commonly reflect grain size characteristics inherited from the source rocks. (Gabriel-USGS)
W70-00650

RELATIONSHIPS BETWEEN GRAIN SIZE, SIZE-SORTING, AND FORESHORE SLOPE ON MIXED SAND-SHINGLE BEACHES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Geography.
R. F. McLean, and R. M. Kirk.
New Zeal J Geol and Geophys, Vol 12, No 1, p 138-155, May 1969. 18 p, 7 fig, 2 tab, 22 ref.

Descriptors: *Sediments, *Marine geology, *Beaches, *Sands, Slopes, Statistical methods, Computers, Hydraulic properties, Waves (Water), Permeability, Fluid mechanics, Analytical techniques, Frequency analysis, Sedimentary structures.
Identifiers: *New Zealand, South Island.

The variation of mean grain size, sorting, and beach face slope over mixed-sand shingle beaches at 2 areas along the east coast, South Island, New Zealand, is analyzed to determine the nature of the relationships between these 3 variables. The study is confined to mean grain sizes between 0.25 and 16.0 mm, and the sorting and slope values associated with this range of sizes. Trend analysis of the data has been performed by fitting curves with the aid of a computer. It is demonstrated that for given beaches curvilinear trends in size/sorting are reflected in slope/size relationship. Thus, the best sorted sediments are found to be associated with the steepest gradients on the curves, while zones of poor sorting are associated with 'plateaus' in the size/slope trend. It is suggested that size is the primary control of sorting trends in the sediments examined while hydraulic effects contribute to variability or spread of the data around the trend. Since size and sorting exert a primary influence on the beach face slope through permeability, it is further suggested that, for the study beaches at least, trends in the size/slope relationship clearly reflect the characteristics local distributions of size and sorting. (Gabriel-USGS)
W70-00651

OFF-SHORE SEDIMENTS, NORTH-WEST NELSON, SOUTH ISLAND, NEW ZEALAND,
New Zealand Oceanographic Inst., Wellington. Dept. of Scientific and Industrial Research.
William J. M. Van der Linden.
New Zeal J Geol and Geophys, Vol 12, No 1, p 87-103, May 1969. 17 p, 11 fig, 2 tab, 15 ref.

Descriptors: *Sediments, *Provenance, *Marine geology, *Currents (Water), *Continental shelf, Erosion, Streamflow, Rivers, Winds, Sands, Petrology, Sedimentation rates, Pleistocene epoch, Bathymetry, Seismic studies, Sampling, Mathematical studies, Mineralogy.
Identifiers: *New Zealand.

The Kahurangi Shoals, north-west of Kahurangi Point, Nelson, and the Westland and D'Urville Currents are the major factors influencing the sediment distribution and sedimentation processes on the north-western shelf of the South Island, New Zealand. The sediments are derived from two major sources, one the Kahurangi Shoals, the other the high Alpine region which supplies its erosion products to sea by steep mountain streams and rivers. The Westland and D'Urville Currents not only carry the Alpine detritus to the area but also largely control the sediment distribution pattern. Immediately south and north of Farewell Spit well sorted wind-blown sands derived from the Spit have accumulated, whereas further south in Golden Bay the sediments are mainly supplied by the Aorere and Takaka Rivers. Petrologically the shelf sands are mainly a quartz-feldspar association with magnetite, ilmenite, garnet, and hornblende as major constituents in the heavy mineral assemblage. The gravels and boulders derived from the Kahurangi Shoals consist mainly of well rounded quartzites. Seismic reflection profiles give an indication of the depositional history during and since the Pleistocene and provide information on the rate of sedimentation. (Gabriel-USGS)
W70-00660

THE APPEARANCE AND ORIGIN OF COLOURS IN MUDDY MARINE SEDIMENTS AROUND NEW ZEALAND,
New Zealand Oceanographic Inst., Wellington. Dept. of Scientific and Industrial Research.
H. M. Pantin.
New Zeal J Geol and Geophys, Vol 12, No 1, p 51-66, May 1969. 16 p, 1 fig, 2 tab, 9 ref.

Descriptors: *Sediments, *Color, *Marine geology, *Geochemistry, Sampling, Chemical analysis, Absorption, Organic matter, Iron compounds, Silicates, Manganese, Mapping, Mud, Analytical techniques, Sedimentation.
Identifiers: *New Zealand.

Muddy marine sediments in the New Zealand region show a considerable range of color. Thirty-five representative samples were selected and divided into groups. Simple chemical tests were applied to these samples in order to obtain information regarding the nature of the chemical compounds which control the color of these sediments. The color of the sediments appears to be controlled mainly by adsorbed compounds of various types. These compounds include: (a) a particular type of organic matter, which gives rise to an olive hue; (b) certain iron compounds (probably silicates) which contain exchangeable ferric iron, and are sometimes partly responsible for an olive hue; (c) ferric oxide or hydroxide, which gives rise to orange, yellowish brown or yellow hues; and (d) manganese dioxide, which also gives rise to orange or yellowish brown hues but which produces considerably darker sediments than ferric oxide or hydroxide. (Gabriel-USGS)
W70-00661

COMPARATIVE ECOLOGY OF SANDSPIT PONDS,
Oberlin Coll., Ohio. Dept. of Biology.
Edward J. Kormondy.
The Amer Midland Natur, Vol 82, No 1, p 28-61, July 1969. 34 p, 9 fig, 10 tab, 53 ref.

Descriptors: *Lakes, *Ecology, *Ponds, *Sand spits, Lagoons, Lake Erie, Organic matter, Vegetation, Plant population, Alkaline water, Carbonates, Water chemistry, Phytoplankton, Seasonal, Carbon radioisotopes, Productivity, Invertebrates, Oxygen, Photosynthesis, Mapping.
Identifiers: Sand spit pond ecology, Presque Island (Pa).

Limnology, productivity and community metabolism of a series of beach and lagoon ponds, located on a sandspit in Lake Erie, Pennsylvania, were investigated by using chemical, biological and geological techniques. Organic matter which has accumulated to a maxi-m-m of 0.8 m in one pond, results in reduction of size approximately 60% and 95% in 50 and 75 yr, respectively. Significant macrovegetational characteristics include the replacement of initial colonizers and the appearance of floating-leaved species in 30 or 40 yr. The ponds are all moderately to well buffered alkaline systems with medium to high levels of carbonates. Phytoplankton density is greatest in late July to early August with the species diversity greatest in midsummer. Annual net productivity is lower in older beach ponds, and standing crop of chlorophyll 'a' showed considerable variation annually and by stage of succession. Colonization by invertebrates is via secondary invasion subsequent to the establishment of the ponds. Community metabolism showed a change in the ratio of photosynthesis to respiration from 1.0 in the youngest pond to 0.33 in the oldest pond. (Gabriel-USGS)
W70-00671

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

POWER, WATER AND FOOD FOR DESERT COASTS: AN INTEGRATED SYSTEM FOR PROVIDING THEM,
Arizona Univ., Tucson. Environmental Research Lab.
Carl N. Hodges, and Carle O. Hodge.

Amer Soc Hort Sci, 66th Ann Meet, Pullman, Wash, Aug 20-22, 1969. Paper, 16 p, 4 fig, 3 tab, 11 ref.

Descriptors: *Arid lands, *Water supply, *Desalination, *Evaporation control, *Vegetable crops, Electric power, Greenhouses, Desalination apparatus, Sea walls, Sea water, Water resources development.
Identifiers: *Gulf of California, *Abu Dhabi, Arabian Peninsula, Diesel generators.

The world has about 20,000 miles of arid coastline with 2.6 million square miles of adjacent arid land 100 feet or less above sea level (a reasonable lift to provide fresh water if it could be obtained economically from the ocean). While much of this land has a sparse population and little or no cultivation, because of the shortage of fresh water, could be productive and habitable if power, food and fresh water were available. Work started in 1966 to design an integrated power-food-water production system for such locations. An integrated, closed environment system was developed utilizing waste heat from diesel-electric generators to desalt sea water. The fresh water is utilized to grow vegetables in air-inflated greenhouses. A pilot plant on the Gulf of California is providing power, water and high quality vegetables for a small fishing community. A large-scale installation is being designed in the Arabian Peninsula Shaikdom of Abu Dhabi. (Crouse-Arizona)
W70-00694

PARAMETRIC ECONOMIC AND ENGINEERING EVALUATION STUDY FOR WATER DESALINATION,
Booz-Allen Applied Research, Inc., Bethesda, Md.
A. P. Christodoulou, G. R. Olsson, and M. J. Monnik.
Office of Saline Water Research and Development Report No 488, 1969. 188 p. OSW Contract 14-01-0001-1825.

Descriptors: *Desalination, *Electrodialysis, *Membrane Processes, Cost Optimization, Plant Design.
Identifiers: *Desalination Apparatus, *Electrochemistry, Computer Algorithm, Economics.

A parametric engineering and economic analysis of the electrodialysis process was performed in which water costs were examined for the demineralization of three reference brackish waters in plant sizes from 1 to 50 mgd. Capital costs were based on scaled-up two-meter stack designs of both the tortuous path and sheet flow types and on detailed plant designs. Operating costs were based on both state-of-the-art technology and on projected technological improvements in critical components and process parameters. A computational algorithm for electrodialysis process analysis and costing was developed and programmed. (Mintz-Office of Saline Water)
W70-00726

ECONOMIC EFFECTS OF USING SUBSTANDARD QUALITY WATER IN WEBSTER AND OTHER COMMUNITIES IN SOUTH DAKOTA.
South Dakota State Univ., Brookings. Coll. of Agriculture and Biological Sciences.
For primary bibliographic entry see Field 03C.
W70-00727

3B. Water Yield Improvement

LAND USE ALONG A TROPICAL CLIMATIC BOUNDARY: THE WALAWE GANGA BASIN OF CEYLON,
National Academy of Sciences-National Research Council, Washington, D.C.
Simon Baker.
Available from Clearinghouse as AD-679 458 for $3 in paper copy, 65 cents in microfiche. Final Rep of Nat Acad Sci-Nat Res Counc, 1968. 251 p, 40 fig, 7 tab, 93 ref. N00014-67-A-0244-0001.

Descriptors: *Land use, *Climatology, *Synoptic analysis, *Rural areas, Tropical regions, Humid areas, Arid lands, Wet climates, Climatic zones, Aerial photography, Surveys, Topography, Mapping.
Identifiers: *Ceylon, Walawe Ganga Basin, Climatic boundaries.

The Walawe Ganga Basin of southern Ceylon, lying partly in the dry and wet zones, is an area which has been earmarked for large-scale development and for settlement of population from the more crowded portions of the wet zone of the Island. It is generally recognized that the wet zone-dry boundary passes through this basin. None of the accepted criteria for the delineation of this boundary agree as to its location in the basin. A major purpose of this study is to show the exact location of the boundary as determined by observations of land use and vegetation types on aerial photographs and in the field. The relationship and influence on the location of the boundary of topography, relief, quantity, and seasonal distribution of rainfall are also examined. Land use throughout the Walawe Ganga Basin and several adjoining areas has been mapped in great detail for the first time. A planimetric analysis of the land use types in the climatic zones shows the quantitative and distributional differences in them. Field observations and interpretation of aerial photographs provide the background for a discussion of qualitative differences between land use types in the climatic zones. A study of the history of land use in the basin over the past 2500 yr indicates previous responses to the physical environment of the basin. (Knapp-USGS)
W70-00463

MICRO-IRRIGATION BY CATCHMENT TANK,
M. G. Ionides.
Ekistics, Vol 24, No 142, p 252-255, 1967. 1 fig.

Descriptors: *Arid lands, *Irrigation, *Water yield improvement, *Impervious membranes, Dry farming, Water supply, Water storage, Semiarid climates, Microenvironment, Water harvesting.
Identifiers: *Catchment tanks, *Micro-irrigation, *Sudan, *Gardens, *Food production.

Attention is drawn to the desirability of developing small catchment and storage system for the irrigation of kitchen gardens as a means of supplying fresh vegetables and fruits to peasant families in semiarid developing countries. Fifty gallons of water a day can provide 10 lbs. of vegetables and fruits daily. Although this is more than might be carried from a village well or spring, it might be provided by a lined and covered tank in the ground with a prepared catchment apron. The successful trial of such a system in the Sudan is discussed. Although the growing season was dry, there was sufficient precipitation at other times to fill the tank. (Crouse-Arizona)
W70-00701

POSSIBILITIES OF MAJOR CLIMATIC MODIFICATION AND THEIR IMPLICATIONS: NORTHWEST INDIA, A CASE FOR STUDY,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02B.
W70-00702

WATER RESOURCES PLANNING IN AUSTRALIA,
Adelaide Univ. (Australia). Faculty of Architecture and Town Planning.
For primary bibliographic entry see Field 06B.
W70-00704

SNOWPACK MANAGEMENT,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W70-00763

3C. Use of Water of Impaired Quality

ECONOMIC EFFECTS OF USING SUBSTANDARD QUALITY WATER IN WEBSTER AND OTHER COMMUNITIES IN SOUTH DAKOTA.
South Dakota State Univ., Brookings. Coll. of Agriculture and Biological Sciences.

Office of Saline Water Research and Development Progress Report No 463, Oct 30, 1969. 192 p. OSW Contract 14-01-0001-463.

Descriptors: Chemical analysis, *Mineral water, *Water softening, Saline water, Brackish water, Desalination, Electrodialysis, Water quality, *Water supply, Costs, Economics, Evaluation, *Economic efficiency.

Webster, S.D., (population 2,500) was one of five sites chosen by the Office of Saline Water for the construction of a desalination demonstration plant. Since 1962, Webster's municipal water supply has been primarily made up of the product water from a 250,000 gpd electrodialysis facility. The purpose of the study was to compare the municipal use of the water before and after the changeover from brackish water to a municipal supply of reduced mineral content. More specific objectives were to compute identifiable cost items related to the use of centrally softened brackish water versus the use of demineralized water. Replacement costs were sharply reduced for hot water heaters installed after 1962. Fifteen other S.D. communities were likewise surveyed. Agreement among users was not clearly unanimous. To the native housewife softness was more important than generally low mineral content. Institutional and commercial users distinctly preferred the demineralized water. (Bovet-Office of Saline Water)
W70-00727

3D. Conservation in Domestic and Municipal Use

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 1 INTRODUCTION,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00528

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 6 STATUTORY MODIFICATIONS OF EASTERN CONSUMPTIVE USE DOCTRINES,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00533

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 13 A LOOK TO THE FUTURE,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 04A.
W70-00540

DEPARTMENT OF CONSERVATION.
For primary bibliographic entry see Field 04C.
W70-00583

AN ENVIRONMENT FIT FOR PEOPLE,
For primary bibliographic entry see Field 06G.
W70-00603

MICRO-IRRIGATION BY CATCHMENT TANK,
For primary bibliographic entry see Field 03B.
W70-00701

3F. Conservation in Agriculture

IRRIGATION IN KENTUCKY AS AFFECTED BY THE LAW OF RIPARIAN RIGHTS,
Hugh C. Evans.
Ky L J, Vol 40, No 4, p 423-433, May 1952. 11 p, 32 ref.

Descriptors: *Kentucky, *Riparian rights, *Irrigation, *Reasonable use, Natural use, Prior appropriation, Natural flow doctrine, Artificial use, Irrigation water, Legal aspects, Usufructuary right, Water law, Judicial decisions, History, Obstruction to flow, Remedies, Water policy, Irrigation districts, Diversion.
Identifiers: *Common law.

Irrigation is becoming increasingly important to the Kentucky farmer. Recent studies show that present economic conditions may necessitate the expanded use of irrigation in the future. This development will undoubtedly present substantial legal problems arising under the Kentucky law of riparian rights. Although the Kentucky court is committed to the natural flow theory, it has on occasion applied what amounts to a reasonable use theory. Although no decision has distinguished which of these theories will be applied to irrigation, case law seems to suggest that Kentucky will follow a rule somewhere between these two theories. This conclusion is drawn after analyzing in detail the two relevant cases decided by the Court of Appeals of Kentucky. The author proposes various hypothetical cases and suggests what the court would do if presented with such a situation. These examples appear to favor the future legal status of irrigation. It is proposed that a solution employing these existing theories would make unnecessary local statutory adoption of any new doctrine of water use, such as the theory of prior appropriation. (Schram-Florida)
W70-00571

REGIONAL DIFFERENCES IN THE IMPACT OF IRRIGATION ON FARM OUTPUT,
Illinois Univ., Urbana; and International Rice Research Inst., Los Banos (Philippines).
J. C. Headley, and V. W. Ruttan.
IN Economics and Public Policy in Water Resource Development, Ames, Iowa State University Press, p 127-149, 1964. 23 p, 2 fig, 3 tab, 5 append, 19 ref. Edited by S. C. Smith, and E. N. Castle.

Descriptors: *Irrigation, *Water allocation, *Economic analysis, *Water resources development, Correlation analysis, Randomness, Investment, Lime, Fertilizer, Humid area, Arid lands, Groundwater, Technology.
Identifiers: *Aggregate production function, *Farm output, *Empirical investment, *Economic growth, Elasticity, Cropland, Cobb-Douglas function, Coefficients, Bias.

This article represents a preliminary report on an attempt to use aggregate production functions to construct estimates of regional differences in the productivity of irrigated cropland. The aggregate production function is discussed with a note of its limitations. Regional production elasticity and marginal productivity estimates are presented and two illustrations demonstrate how the results can be used to assess the impact of irrigation development on the growth of farm output. Statistical estimates of irrigation productivity are given for major agricultural regions in the U.S., indicating reliable quantitative estimates of factor productivity coefficients and marginal productivity estimates in most areas. Only the direct irrigation benefits were dealt with, leaving a need for cost analysis in all areas. Incremental increases in irrigation inputs were studied in both humid and arid regions. The analysis emphasized broad possibilities of substitution among aggregate input categories to achieve given output levels in each region. (Murphy-Rutgers)
W70-00624

IRRIGATION WATER USE IN THE UTAH VALLEY, UTAH,
Central Michigan Univ., Mount Pleasant.
James Hudson.
Chicago, University of Chicago, 1963. 249 p.

Descriptors: *Water supply, *Irrigation, *Economics, *Land use, *Utilities, *Water management, Agriculture, Population, Income, Farms, Climates, Natural flow, Financing, Prices, Costs, Water yield, Irrigation efficiency, Water rates, Reservoirs, Wells, Springs.
Identifiers: *Utah Valley, *Water companies.

This study attempts to describe the water use management practices important to irrigation water use and to canvass the whole range of factors, physical, economic and institutional, which affect water use and the variations of water use in a particular area. It provides an estimate of the actual water use and irrigation efficiencies in the valley. The problems of measurement of efficiency are discussed and the results of different available measures are compared. It examines the conditions in the area which encourage or hinder changes in irrigation water use. Of particular interest to the economist is the section which examines the irrigation water companies as the intermediate step between surface supply and the farmers. (Murphy-Rutgers)
W70-00627

ADVECTIVE CONTRIBUTION OF ENERGY UTILIZED IN EVAPOTRANSPIRATION BY ALFALFA IN THE EAST CENTRAL GREAT PLAINS (U.S.A.),
Nebraska Univ., Lincoln. Agricultural Experiment Station; and Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
For primary bibliographic entry see Field 02D.
W70-00690

AGRICULTURAL METEOROLOGY IN ISRAEL,
Nebraska Univ., Lincoln.
Norman J. Rosenberg.
American Meteorological Society, Bulletin, Vol 50, No 6, p 444-445, June, 1969. 2 fig.

Descriptors: *Micrometeorology, *Arid lands, *Water utilization, *Irrigation, *Agriculture, Windbreaks, Energy budget, Greenhouses, Environmental effects, Soil temperature, Deserts.
Identifiers: *Agrometeorology, *Israel.

The author presents a brief review of the state of research on micrometeorological and environmental effects in agricultural research in Israel as of 1968. Research is directed toward optimization of water use in irrigated agriculture. Instrumentation was somewhat less sophisticated than that in Europe and the United States. Extensive work was in progress to develop efficient use of windbreaks and greenhouses as well as soil covers to control soil temperature and evaporation and to extend the growing season for high value specialty crops. The author concluded that Israel, with an arid climate and severely limited water supply, could benefit greatly from continued agrometeorological research. (Crouse-Arizona)
W70-00691

THE QANATS OF IRAN,
For primary bibliographic entry see Field 04B.
W70-00692

THE CONDITIONS FOR ECONOMIC GROWTH OF THE ARID LANDS,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.
W70-00693

SPRINKLER IRRIGATION,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.; California Univ., Los Angeles. Water Resources Center; and International Study Center for Sprinkler Irrigation, Verona (Italy).
Arthur F. Pillsbury, and Ariosto Degan.
Food and Agriculture Organization of the United Nations, FAO Agricultural Development Paper No. 88, 1968. 179 p, 66 Fig, 15 Tabs, 9 graphs, 87 ref, 4 append.

Descriptors: *Sprinkler irrigation, *Irrigation design, Irrigation operation and maintenance, Economic feasibility, Arid lands, Construction costs, Cost-benefit ratio, Operating costs, Depreciation, Hydraulic design.

Irrigation can be used as a supplement in arid zones as a substitute for natural rainfall to supply soil moisture for growing plants and, sometimes, to control surface temperatures. Subsurface, surface, and sprinkler application methods can be used. Sprinkler methods offer greater uniformity of coverage, frequently at lower application rates. This paper presents a broad review of situations in which sprinkler irrigation should or should not be used. It examines factors that affect system performance and design criteria of which the planner should be aware when designing an irrigation system. Special uses such as fertilizer and pesticide application and frost protection are discussed. The most obvious applications are in arid or semi-arid zones or in areas where natural precipitation is inadequate or unpredictable during the growing season. Since farming is a business, an irrigation system should not be installed unless estimated increase in value of product exceeds direct and indirect costs of installations and operation. Discussion of costs includes suggested depreciation periods for various system components, interest rates, and data for estimating operating and maintenance costs. (Crouse-Arizona)
W70-00695

NOTES ON PROBLEMS OF IRRIGATION IN THREE LIBYAN OASES,
For primary bibliographic entry see Field 04B.
W70-00703

IRRIGATION IN THE AMU-DAR'YA BASIN: PROGRESS REPORT,
Ann Sheehy.
Central Asian Review, Vol 15, No 4, p 342-353, 1967. 1 map.

Descriptors: *Arid lands, *Irrigation systems, *Irrigation canals, *Canal seepage, *Drainage systems, Land development, Hydroelectric power, Saturated soils.
Identifiers: *Central Asia, *Amu-Dar'ya Basin, U.S.S.R., Aral Sea.

The article, compiled from Russian language newspapers and journals, deals with irrigation developments in the Amu-Dar'ya Basin as reported between 1963 and 1967. Citations of original articles are not always included. The Amu-Dar'ya empties into the Aral Sea. About two-thirds of the average annual flow (70 milliard cubic meters) reaches the Aral Sea, but current plans are to divert almost all of the water for irrigation by 1980. Structures will be multi purpose and also generate electricity, part of which will be used to lift irrigation water where necessary and the rest made available for urban-industrial development. The various projects in operation, under construction and in planning stages are reviewed briefly and individually. Many projects are apparently running behind schedule due to excessive losses from seepage from canals, inadequate provision for drainage of newly developed lands, and inadequate technical knowledge of many farmers as to efficient use of irrigation water. Various measures to correct these short comings are discussed briefly. As more and more flow is diverted to irrigation the Aral Sea will shrink. This will have disastrous effect on fishe-

ries and other industries presently located along the shore. The concensus is that this will be outweighed by the value derived from the eight million hectares of land that will be brought under irrigation. Climatological experts discount the threat of serious effects due to shrinkage or disappearance of the Aral Sea. (Crouse-Arizona)
W70-00705

SOIL AND WATER CONSERVATION DISTRICTS LAW.

SC Code Ann secs 63-51 thru 63-165 (Supp 1968).

Descriptors: *South Carolina, *Conservation, *Erosion control, Legislation, Soil conservation, Water conservation, Demonstration farms, Demonstration watersheds, Land management, Contour farming, Soil management, Erosion, Farm management, Land development, Land use, Cover crops, Cultivation, Sediment control, Terracing, Water management, Water resources, Water resources development, Watershed management, Water utilization, Flood control, Fallowing.
Identifiers: Conservation districts.

A State Soil and Water Conservation Committee is composed of one supervisor from each of the state's five soil conservation districts, and its function is to coordinate and assist the supervisors of these districts. Provisions are made for the formation of new districts by petition of landowners to the Committee to hold a referendum. If approved by the referendum, application is filed with the Secretary of State who files and records the application. Similar procedures allow for including additional territory within existing districts, for subdividing districts, and for their discontinuance. Upon discontinuance, regulations made by the district are nullified, but the Committee is substituted as party to all contracts. Three supervisors are elected by the voters in each district for three-year terms and are removable for malfeasance only. Districts may conduct surveys, research, and demonstration projects in cooperation with other federal or state agencies; carry out preventive and control projects for soil and water; aid other agencies; and develop comprehensive plans for soil and water conservation. A board of adjustment is established to hear hardship petitions concerning land use regulations in each district. (Douberley-Florida)
W70-00736

ILLINOIS DRAINAGE CODE.
For primary bibliographic entry see Field 06E.
W70-00737

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

REMOVAL OF VEGETATION FROM WATERCOURSES.

Ind Ann Stat secs 11-1201 thru 11-1205.

Descriptors: *Indiana, *Vegetation, *Fresh water, *Conservation, Legislation, Plants, Drainage, Administrative agencies, Beaches, Boat-launching ramps, Permits, Land tenure, Weeds, Lakes, Streams, Rivers, Legal aspects, Regulation.
Identifiers: *Removal, Penalties (Criminal), Licenses.

No person, firm, or corporation shall take or remove any weeds, moss, or other water vegetation from any freshwater lake, stream, or river of this state unless such person, firm, or corporation has procured a license to do so. Such license shall be issued by the Division of Fish and Game of the Conservation Department. Any removal of water vegetation shall be done within regulations prescribed by the Division. The provisions of this act shall not apply to persons removing water vegetation to improve drainage, nor to any adjacent landowner who removes vegetation from the immediate vicinity of any boat landing or bathing beach. Violation of the provisions of this act shall be a misdemeanor. (Heckerling-Florida)
W70-00437

ENGINEERING PHASES OF LAND TREATMENT RELATED TO INCREASING WATER-USE EFFICIENCY AND STORAGE EFFICIENCY RAINFALL,
Nebraska Univ., Lincoln.
Howard D. Wittmuss.
Nebr Univ Water Resources Res Inst Proj Completion Rep, July 1969. 11 p, 1 fig, 1 tab. OWRR Proj No A-003-NEB.

Descriptors: *Land management, *Soil conservation, *Water conservation, *Terracing, Erosion control, Drainage, Mulching, Cover crops, Water storage, Soil temperature, Soil moisture, Electrical resistance.
Identifiers: Experimental watersheds.

Three systems of parallel steep backslope terraces were installed, field tested and evaluated as a new and improved soil and water conservation practice compatible with the operation of modern large scale, high speed farm machinery. A till-planter and system of mulch tillage were developed and used with the improved conservation systems. Runoff, soil loss and peak rate of runoff were reduced 1/3, 9/10 and 37/38 respectively, for the new conservation systems compared to a similar non-conservation watershed. Improvements in tile line design, in the size and arrangement of perforated openings in the terrace outlets, and in the method of sealing the terrace ridge to seepage of water along the tile line were recommended. A sediment sampler which would automatically collect a representative runoff sample was designed, constructed and field tested. A power series formula was developed for predicting changes in electrical resistance with changes in soil temperature. The electrical resistance blocks can be used to determine the soil moisture level in a soil over a wide range of temperatures. A theory and predication formula was developed for determining head pressure and friction losses for pipeline joints in tile. The potential evapotranspiration was determined for bromegrass under different levels of soil moisture stress for dryland conditions. (Knapp-USGS)
W70-00448

A STUDY OF THE ECONOMIC IMPACT OF WATER IMPOUNDMENT THROUGH VALIDITY TESTING OF A COMPARATIVE-PROJECTOR MODEL,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 06A.
W70-00479

LEVEES.

Ind Ann Stat secs 27-810 thru 27-818 (1960).

Descriptors: *Indiana, *Levees, *Administrative agencies, Maintenance costs, Costs, Assessments, Weed control, Weeds, Washouts, Pumping, Legislation, Condemnation, Earthworks, Embankments, Maintenance, Repairing, Legislation, Administration.
Identifiers: Negligence, Penalties (Civil).

The committee placed in charge of a levee has full power to repair and maintain the same and may change the levee's location when necessary. Repair costs are generally assessed against the lands benefitted thereby; however, where such repairs are rendered necessary due to the negligence of a landowner or occupant, costs are assessed against his lands alone. The committee may fence levees and adopt measures to keep levees free from weeds. Upon petition by the landowners protected by a levee, the committee may make additions thereto. The committee may also, upon written request by the protected landowners, take all necessary steps to prevent the encroachment of any stream and the washing away of the stream banks. The committee may pump out or take necessary steps to remove water collected on lands protected by such levee. Land necessary for the maintenance of an authorized levee may be obtained by purchase or condemnation. It is unlawful to drive over or upon any levee. (Marsee-Florida)
W70-00485

PROPERTY RIGHTS OF RIPARIAN OWNER IN MISSOURI WITH RESPECT TO OBSTRUCTION OF A NATURAL OR ARTIFICIAL WATERCOURSE,
For primary bibliographic entry see Field 06E.
W70-00525

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 2 RIGHTS IN DEFINED WATERBODIES BASIC CONSIDERATIONS,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00529

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 10 SINGLE PURPOSE AND MULTIPURPOSE WATER MANAGEMENT DISTRICTS,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00537

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 13 A LOOK TO THE FUTURE,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 13, p 406-419, 1968.

Descriptors: *Florida, *Water conservation, *Administrative agencies, *Planning, Administration, Forecasting, Water allocation (Policy), Water resources development, Legal aspects, Federal government, State governments, Grants, Hydrologic cycle, Water pollution, Recreation, Research and development, Access routes, Consumptive use, Water utilization, Domestic water, Water pollution control.

The nation as a whole is in the early stages of a water crisis. Florida, however, has sufficient water resources to serve the needs of her citizens for at least the foreseeable future, provided that this resource is properly utilized. It is strongly recommended that a master plan for water resources development be formulated at once. Such a formulation requires adequate funds for research and a central state agency with authority to represent the state in all water use determinations. Planning must be based on hydrologic units with political considerations subordinated to scientific and aesthetic exigencies. Pollution abatement programs must be implemented at once. Planning for state acquisition and development of shoreline should be a part of any long-range water use program in Florida. Legal doctrines must be formulated which will secure to the public at large access rights in privately owned navigable waters. There is a need for legislation to regulate consumptive uses of water and to create hydrologically sound water management districts. Finally, investigations should be made concerning the feasibility of water movement from North Florida to the population centers of South Florida. (See W70-00527). (Wheeler-Florida)

W70-00540

INTERFERENCE WITH THE PUBLIC RIGHT OF NAVIGATION AND THE RIPARIAN OWNER'S CLAIM OF PRIVILEGE,
For primary bibliographic entry see Field 06E.
W70-00546

REAL PROPERTY--EASEMENTS--CONSTRUCTION OF INSTRUMENT GRANTING RIGHT OF FLOWAGE,
George A. Kronenberg.
Ala L Rev, Vol 14, No 2, p 463-470, Spring 1962. 8 p.

Descriptors: *Alabama, *Boundaries (Property), *Water rights, *Riparian rights, Legal aspects, Judicial decisions, Dam construction, Dams, Overflow, Lakes, Drainage, Easements, Fishing, Contracts, Navigable waters, Streams, Boating, Swimming, Recreation, Natural streams, Water law, Impounded waters, Ownership of beds, Water utilization, Non-navigable waters, Preferences (Water rights).
Identifiers: *Easements of flowage, Easements appurtenant, Easements in gross, Water privileges.

In Hill v Davis, 130 So 2d 39 (Ala 1961), the plaintiff dammed a branch on his property and obtained an easement of flowage from the defendant. Litigation ensued when the defendant built a fence along his boundary while the lake was temporarily drained. The appellate court held that the interpretation placed upon contracts by the parties and practiced by them will be accepted by the court, and that the right to take fish in any water which is not navigable follows the ownership of the water, if that is separated from the ownership of the soil. Since the lake had been used by the plaintiff as a commercial fishing lake for thirty years prior to the time when the defendant built his fence, the court found that the parties had interpreted the easement of flowage as including fishing rights. After the law of easements is considered, it is concluded that what was here granted was an easement appurtenant. An analysis of cases leads to the conclusion that in interpreting clear and unambiguous grants the weight of authority is to the effect that rights of boating and fishing are not incidental to an easement of flowage and must be specified in the grant; it is noted that the court could have reached the same result on the basis of prescriptive use. (Keith-Florida)
W70-00548

FEDERAL ENCROACHMENT ON STATE WATER RIGHTS,
For primary bibliographic entry see Field 06E.
W70-00549

THE NAVIGATION SERVITUDE AND JUST COMPENSATION--STRUGGLE FOR A DOCTRINE,
Richard W. Bartke.
Oregon L Rev, Vol 48, No 1, p 1-44, Dec 1968. 44 p, 194 ref.

Descriptors: *Condemnation, *Eminent domain, *Navigable waters, *Federal government, Condemnation value, Right-of-way, Water rights, Easements, Legal aspects, Cost repayment, Compensation, Local governments, State governments, Federal Power Act, Federal-state water rights conflicts, Navigation, Administrative agencies, Admiralty, Federal jurisdiction, United States.
Identifiers: *Navigation servitude, Commerce power.

The federal interest in navigable waters or 'navigation servitude' is a proprietary one. The development of the concept of navigation servitude is traced from early holdings of the Supreme Court on the commerce power and admiralty jurisdiction granted the federal government in the Constitution. Past and present attitudes of the courts in awarding compensation for condemned lands adjoining navigable waters is examined. The most recent court decisions indicate that compensation will be based upon the government's interest in the flow of the stream in question, not the type of improvement or special adaptability of the land involved. Condemnation by local and state governments and private bodies holding licenses from the Federal Power Commission is also discussed. In these proceedings the licensees should be treated as is the United States in regard to compensation awards and collection of charges for use of assets in the public domain. The author urges development of a comprehensive doctrine, based upon the proprietary nature of navigation servitude, to replace the case by case approach used thus far in solving these water rights problems. (Kelly-Florida)
W70-00559

REAL PROPERTY: DISPOSITION OF DIFFUSED SURFACE WATERS IN NORTH CAROLINA,
William P. Aycock.
NC L Rev, Vol 47, No 1, p 205-218, Dec 1968. 14 p, 81 ref.

Descriptors: *North Carolina, *Surface waters, *Surface runoff, *Riddance (Legal aspects), Surface drainage, Repulsion (Legal aspects), Judicial decisions, OBSTRUCTION TO FLOW, Alteration of flow, Diversion, Natural flow doctrine, Reasonable use, Relative rights, Streamflow, Watercourses (Legal), Natural streams, Drainage.
Identifiers: Civil law, Common enemy rule.

Surface water is defined as that water derived from precipitation or from springs, which is diffused over the surface of the ground. It is distinguished from water flowing into a natural watercourse or forming an identifiable water body. Three basic rules have developed in various jurisdictions concerning disposal of surface waters by landowners. These are: (1) the civil law rule, which requires continuation of natural drainage conditions through imposition of servitudes on lower landowners; (2) the common enemy rule, which permits a landowner to obstruct surface flow without liability; and (3) the reasonable use rule, which imposes liability only for unreasonable alteration of flow. North Carolina early adopted the civil law rule regarding surface water disposal. An analysis of cases reveals some modification of that rule to permit artificial drainage into a natural watercourse, even where acceleration and increase in flow occur. In view of the current trend toward industrialization and urbanization, the author predicts further modification by North Carolina courts to meet future problems. (Kelly-Florida)
W70-00561

THE APPROPRIATION OF PROPERTY FOR LEVEES: A LOUISIANA STUDY IN TAKING WITHOUT JUST COMPENSATION,
Richard P. Wolfe.
Tul L Rev, Vol 40, No 2, p 233-288, Feb 1966. 56 p, 223 ref.

Descriptors: *Louisiana, *Condemnation, *Condemnation value, *Levees, Compensation, Right-of-way, Easements, Eminent domain, Judicial decisions, Legal aspects, Land tenure, Land appraisal, Land use, Flood control, Flood protection, Dikes, State jurisdiction, Federal government, Mississippi River, Public rights, Boundaries (Property), Riparian rights, Navigable rivers.

Governmental authorities in Louisiana have experimented with different methods of obtaining lands for levee construction and of financing levee systems. After surveying the historical development of Louisiana's levee systems, the author concludes that the scope of levee construction has so increased that the traditional method of taking lands is no longer justifiable. The doctrine of appropriation under riparian servitude is grounded in civil law concepts inherited by Louisiana from France and Spain. The author related the doctrine to the state's exercise of its police power by which land is taken for the public welfare without compensation. The courts have rationalized appropriation both as an exercise of police power and as an application of the reserved-right theory (by which the state retains a servitude in all riparian land grants). The author notes the inadequacy of the compensation that may be given, discusses the unclear status of the appropriated land and the broadness of the power to appropriate, and questions the constitutionality of the appropriation doctrine. (Kelly-Florida)
W70-00562

THE APPROPRIATION OF PROPERTY FOR LEVEES: A LOUISIANA STUDY IN TAKING WITHOUT JUST COMPENSATION,
Richard P. Wolfe.
Tul L Rev, Vol 40, No 2, p 233-254, Feb 1966. 56 p, 223 ref.

Descriptors: *Louisiana, *Condemnation, *Compensation, *Levees, Flood control, Mississippi River, Administration, Maintenance, Planning, State jurisdiction, Federal government, Public health, Public benefits, Flood protection, Land tenure, Land use, Riparian rights, Riparian land, Severance, Legal aspects, Banks, Public rights.

Examination of the historical development of financing and planning levees in Louisiana reveals that originally private riparian landowners were responsible for maintaining levees on their lands. Levee districts were later established and continue to administer the levee system, subject to technical advice from state or federal engineers. The districts appropriate land or levee sites without payment of just compensation under the doctrine of appropriation under riparian servitude. Other states take land for these purposes via eminent domain, but Louisiana traditionally has held that construction of levees on private property is a regulation of the owner's use of the land in the interest of public safety, not a use of the owner's land for the public. The appropriation doctrine is further justified under the reserved-right theory. At common law beds of tidewater rivers are owned by the sovereign. Under the civil law of France and Spain, however, rivers belong to all men in common, and the banks, though owned by riparian landowners, were subject to public use or servitude. Louisiana adheres basically to the civil law rule, limiting its application to navigable rivers and to flood control. (Kelly-Florida)
W70-00563

THE APPROPRIATION OF PROPERTY FOR LEVEES: A LOUISIANA STUDY IN TAKING WITHOUT JUST COMPENSATION,
Richard P. Wolfe.
Tul L Rev, Vol 40, No 2, p 255-288, Feb 1966. 56 p, 223 ref.

Descriptors: *Louisiana, *Levees, *Condemnation, *Compensation, Land tenure, Eminent domain, Easements, Condemnation value, Land appraisal, Riparian land, Riparian rights, Ownership of beds, State governments, State jurisdiction, Civil law, Flood control, Navigable rivers, Reasonable use, Relative rights, Appropriation, Sites, Beds.
Identifiers: *Retained-right theory, Constitutional law, Civil law.

Using either police power or the reserved-right theory as justification, the appropriation doctrine permits taking of land for levee sites with no compensation. Statutes permit compensation for the assessed value of the land, but the author contends that compensation must be for fair market value to be constitutionally just. The status of land taken is unclear under Louisiana case law. There is some question as to whether land located on the river side of a levee is part of the bed unless it is inundated. Title to land not part of the bed is retained by the original owner. The scope of the power to take beyond adjoining riparian lands has been extended to include all land reasonably necessary in

the situation. The land taken must be used solely for flood control on the adjoining river. The constitutionality of the appropriation doctrine is questioned when it is based upon the retained-right theory due to the lack of title chain from the state to much private land, inclusion of land not directly adjoining a river, inadequate compensation for improvements, and lack of judicial review. (Kelly-Florida)
W70-00564

COMPENSATION FOR THE RIGHT OF ACCESS TO NAVIGABLE WATERS,
Leighton S. Houck.
Wash and Lee L Rev, Vol 26, No 1, p 136-143, Spring 1968. 8 p, 29 ref.

Descriptors: *Kentucky, *Riparian rights, *Riparian land, *Access routes, Right-of-way, Condemnation, Eminent domain, Judicial decisions, Navigable waters, Legal aspects, Water law, Compensation, Condemnation value, Governments, Public benefits, Public rights, Shores, Coastal structures, Damages.

According to a recent Court of Appeals of Kentucky decision, riparian landowners have the right of a reasonable access to the entire body of water on which their land borders. Such a right has value, and before the state may take or impair such right, it must pay the owner just compensation therefor. There is universal agreement among both state and federal courts that a riparian landowner must be compensated for any actual physical encroachment by the government. These courts, however, do not agree as to whether there should be recognized any right of access at all, even ingress and egress, as a valuable property right and, if so recognized, the extent of that right. Jurisdictions which do recognize the right of access as a valuable property right nevertheless deny compensation if the governmental action is for the purpose of improving navigation. Rather than utilizing rigid doctrinaire concepts, the court looked first at the individual's investment in the land and then weighed this interest against the demands of commerce. Thus, by applying a test of fairness, the fact that a proper governmental function is being performed will no longer by itself be a basis for denying compensation. (Schram-Florida)
W70-00566

THE RIGHT OF ACCESS TO NAVIGABLE WATERS--COMPENSABILITY UNDER EMINENT DOMAIN,
Thomas C. Spencer.
Wash and Lee L Rev, Vol 25, No 2, p 323-328, Fall 1968. 6 p, 22 ref.

Descriptors: *Access routes, *Riparian rights, *Compensation, *Eminent domain, Public benefits, Riparian land, Navigable waters, Condemnation value, Damages, Water law, Judicial decisions, Legal aspects, Governments, State governments, Condemnation, Navigation, Federal government, History.

The federal rule governing compensation for taking a riparian landowner's access to navigable waters for a public use is that no compensation need be given if there is no physical encroachment upon or taking of land and if the governmental act is to improve navigation. This has been extended to make the federal government immune from making compensation for nearly any act so long as there is no physical encroachment upon the land. A majority of the states follows the rule that if the work is not to aid navigation, the riparian landowner may recover for any right lost or damaged. Rather than expanding the navigational servitude immunity, however, some of these states have said that the right of access is a general right held by the public which can be taken for the good of the public in general. A minority of states find that there can be no private rights in the public domain and therefore, no compensation is ever necessary. The right of access to navigable waters is a public right held in trust by the state. Thus, either as a rule or through interpretations, the tendency today is towards not compensating riparian owners. This is justified by recognizing that if compensation were required, the cost of public improvements would be prohibitive, and commerce would be considerably impeded. (Schram-Florida)
W70-00567

WATER--AS A SPECIES OF PRIVATE PROPERTY--THE ILLINOIS VIEW,
John E. Cribbet.
Ill B J, Vol 47, No 5, p 449-477, Jan 1959. 29 p, 77 ref.

Descriptors: *Illinois, *Riparian rights, *Usufructuary right, *Water rights, Prior appropriation, Water law, Natural flow doctrine, Natural flow, Water pollution, Consumptive use, Alteration of flow, Navigable waters, Prescriptive rights, Reasonable use, Navigation, Drainage.
Identifiers: Property rights.

Whether water is a property right is a question answerable only after an understanding of differing water laws. Western states use agencies to supervise a prior appropriation system of vested water rights based on an appropriation of water by the earliest user. Illinois follows the common-law riparian doctrine of water rights wherein riparian owners along watercourses have a usufruct in water as it passes their land. This right of use is protected as a vested property right subject to a public easement for navigation. Riparians have equal rights to use the passing water, but use by one riparian cannot deprive others of an equal opportunity to the water. Riparian rights are based on the natural flow doctrine of watercourses and modified in cases of pollution and consumption to reasonable use test. Illinois follows the Roman Law of natural drainage, modified and augmented by a comprehensive Drainage Code. Recent legislation establishing water study and control boards reveals Illinois' concern with its water problems. (McDonough-Florida)
W70-00568

CIVIL LAW PROPERTY--BEDS OF NAVIGABLE WATERS--SUSCEPTIBILITY OF PRIVATE OWNERSHIP.

La L Rev, Vol 14, No 1, p 267-273, Dec 1953. 7 p, 27 ref.

Descriptors: *Louisiana, *Navigable waters, *Ownership of beds, *Public rights, Lakes, Beds under water, Judicial decisions, Legislation, Land tenure, State governments, Patents, Civil law.
Identifiers: Private rights.

Since 1812, beds of navigable waters have been regarded as belonging to the state as public lands. Public lands were traditionally classed as either susceptible or insusceptible of private ownership, with navigable stream or lake beds being insusceptible of such ownership. The legislature has consistently excluded beds of navigable waters in legislation authorizing disposition of public lands. The judiciary announced its adherence to the insusceptibility view in the landmark case of Miami Corporation v State, 186 La 784, 173 So 315 (1936), based on principles of public policy. Yet, in Humble Oil Company v State Mineral Board, 223 La 47, 64 So 2d 839 (1953), the court did not even acknowledge this principle of insusceptibility. The court did not consider the state's contention that the conveyance of the tract of land which included a navigable lake could not have passed title to the bed of the lake since not authorized by statute. The court merely relied on Act 62 of 1912, which placed a 6 year limitation on suits by the state to annul patents. In so doing, the court applied the act to the transaction in question without inquiry into the statutory authority of the patent alienating the public land. In view of the conflicting decisions, a re-examination of the Humble Oil decision in future cases seems warranted. (Harris-Florida)
W70-00569

WATER BOUNDARIES,
Fred K. Read.
Ky State B J, Vol 8, No 4, p 10-12, Sept 1944. 3 p.

Descriptors: *Kentucky, *Ohio River, *Riparian rights, *Boundaries (Property), Accretion (Legal aspects), Avulsion, Bank erosion, High water mark, Low water mark, Legal aspects, Ownership of beds, Navigable waters, Non-navigable waters, Tidal waters, Judicial decisions, Legislation, Cities, Banks, Beds, Riparian land.
Identifiers: *Common law.

Under English common law, the beds and shores of all tidal waters were owned by the crown. All other lands beside and under the waters were susceptible of private ownership, regardless of the navigability of the waters. Although most states differ, Kentucky allows the title to the banks and beds of all rivers and streams, regardless of navigability, to vest in the abutting property owner. This is subject only to the public easement in navigation. A riparian landowner owns to the center of the stream and is entitled to any accretions by avulsion or reliction, and must accept any loss due to erosion or dereliction. In the case of the Ohio River, even though Kentucky's ownership extends to the far bank, riparian owners in Kentucky still own only to the center line. This rule also applies to municipalities, except for third-class cities who, by statute, had their boundaries extended to the low water mark of the opposite shore. (Schram-Florida)
W70-00570

DETERMINATION OF RIGHTS TO REAL PROPERTY ALONG THE MISSOURI RIVER IN CONNECTION WITH RIVER STABILIZATION,
Robert M. Underhill.
Iowa L Rev, Vol 42, No 1, p 58-62, Fall 1956. 5 p, 28 ref.

Descriptors: *Iowa, *Missouri River, *Accretion (Legal aspects), *Boundaries (Property), Avulsion, Stabilization, Judicial decisions, Legislation, Interstate compacts, Riparian rights, Legal aspects, Ownership of beds, Riparian land, Water law, High-water mark, Stream stabilization, Channels, Meanders, Sand bars, Islands, Federal government.

Stabilization of the Missouri River channel by the United States Corps of Engineers will cause many legal problems. Questions will arise relative to the western boundary of Iowa, and pertaining to private titles to lands which hitherto were accretions, islands, or submerged lands beneath the Missouri River. A solution to the Iowa boundary problem has been accomplished by an agreement between executive authorities of Iowa and Nebraska. This, together with reciprocal legislative enactments, seemingly settle the western boundary of Iowa along the stabilized channel of the Missouri River. Riparian owners of land along the banks of a navigable stream hold title to accretions to their lands to the high-water mark of the stream. Land suddenly annexed to the state's domain through avulsion, however, is not susceptible to riparian ownership. When such avulsion creates sandbars and islands, conflicts between riparian owners and Iowa will arise. Because a substantial amount of land will be added to Iowa by reason of the channel stabilization, claims of private individuals based upon adverse possession and the doctrine of prescription will be made. An additional area of controversy will be the apportionment of frontages among the riparian owners along the new river course. (Schram-Florida)
W70-00572

LITTORAL RIGHTS ON THE GREAT LAKES,
For primary bibliographic entry see Field 06E.
W70-00574

REAL PROPERTY--WATER RIGHTS--PUBLIC RIGHTS OF FISHING AND NAVIGATION OVER FLOODED LANDS.
Vand L Rev, Vol 5, No 3, p 669-671, Apr 1952. 3 p, 21 ref.

Descriptors: *Fishing, *Floodwaters, *Relative rights, *Land tenure, Water rights, Real property, Navigable waters, Navigation, Flooding, Legal aspects, Riparian rights, Riparian land, Boating, Hunting, Public rights, Land, Sport fishing, Ownership of beds, Recreation, Usufructuary right, Avulsion, Tidal waters.
Identifiers: Submerged lands.

In Bohn v Albertson, 238 P2d 128 (Calif App 1951), the lessees of a flooded tract of land sought to enjoin the public from fishing thereon. The court held that the public had the right to fish and boat. Once title to land is acquired, it is not affected when the property becomes submerged under navigable waters by avulsion. Although the landowner may drain and reclaim the land, the public has an easement of navigation in such waters. The fact that at common law the public right of fishing was coextensive with the right of navigation in state-owned, tidal waters has led some American jurisdictions to disregard the separate nature of these rights. These jurisdictions have extended the fishing right to all navigable waters, regardless of who owns the stream bed. However, the majority of courts hold that the right to fish and hunt is an incident of land ownership, exclusive in the riparian owner. Where private land is inundated, cases have unanimously allowed the owner the private right of fishing. The view of the instant case is, however, consistent with the public nature of inland fishing. (Marsee-Florida)
W70-00575

THE MOVEMENT FOR NEW WATER RIGHTS LAWS IN THE TENNESSEE VALLEY STATES,
For primary bibliographic entry see Field 06E.
W70-00577

WATER NAVIGATION REGULATIONS.
For primary bibliographic entry see Field 06E.
W70-00587

PROVISIONS AS TO DITCHES, DRAINAGE, AND RECLAMATION.

Ky Rev Stat Ann secs 269.210-269.270 (1963).

Descriptors: *Kentucky, *Drainage districts, *Drainage programs, *Local governments, Legal aspects, Construction, Maintenance, Eminent domain, Condemnation, Costs, Taxes, Assessments, Legislation, Inspection, Construction costs, Cities, Obstruction to flow.

Any drainage corporation may extend or construct additional ditches to facilitate drainage and may use the power of eminent domain to condemn needed lands. Upon petition of the corporation and after hearing, the county court may order the extension by the corporation. The landowner in any county of 25,000, through whose land a non-navigable stream has its natural outlet or a ditch or drain has been constructed, must keep the same free from obstructions. The county engineer shall inspect such streams and ditches and notify the owner of any obstructions. If the owner fails to remove said obstructions, the engineer shall cause them to be removed and the cost will become a lien upon the land. Any person, upon approval of the drainage board, may petition the county court to be removed from a drainage district. The county court for any county may establish a county-wide surface water drainage district to be paid for by county taxes and may acquire all necessary rights-of-way by purchase or condemnation. (Darragh-Florida)
W70-00590

DRAINAGE MAINTENANCE AND REPAIR DISTRICTS.
Ind Ann Stat secs 27-243 thru 27-250 (1960).

Descriptors: *Indiana, *Drainage districts, *Ditches, *Administrative agencies, Assessments, Maintenance costs, Governments, Legislation, Legal aspects, Adjudication procedure, Construction costs, Drainage, Financing, Administration, Maintenance, Repairing, Drainage systems.

Where a public ditch or drain has been or shall be constructed pursuant to the order of any circuit or superior court or board of county commissioners, the owners of assessed real estate, who would benefit by the construction of such drain or ditch, may file a petition with the circuit or superior court in their county seeking the establishment of a Drainage Maintenance and Repair District. When such proposed district includes a city or town, the common council or town board of the city or town may sign the petition on behalf of landowners within that city or town. After a hearing and opportunity for contest by landowners within the proposed district, the court may establish such proposed district. Commissioners appointed by the court must maintain such ditch or drain in proper condition and are authorized to hire all labor and purchase all material necessary therefor. Lands benefited by such maintenance are assessed in advance for the costs thereof. Upon petition by landowners, any maintenance district under this act may be dissolved by the court which established it. (Marsee-Florida)
W70-00594

DRAINS: RIGHT-OF-WAYS--OBSTRUCTIONS--CROSSINGS--CONNECTIONS.
Ind Ann Stat secs 27-2301 thru 27-2310 (Supp 1968).

Descriptors: *Indiana, *Administrative agencies, *Obstruction to flow, *Easements, Drainage, Drainage systems, Drains, Ditches, Planning, Right-of-way, Construction, Maintenance, Relocation, Levees, Bridges, Culverts, Legislation, Public utilities, Bridge construction, Highways, Railroads.

Authorized personnel from the county drainage board have a right of entry over and upon lands lying within 75 feet of any legal drain. Unless approved by the county drainage board in the county in which the drain lies, objects, crops, and trees along the easement run the risk of removal or damage. Obstructions are to be removed from drains and any needed repairs made immediately either by the landowner causing the obstruction or by the board. The cost of repairs made by the board may be assessed against a landowner causing the harm. Pipeline companies, public utilities, or other persons may be required, by suit if necessary, to relocate their equipment or repair damages caused by them to any legal drain. Proposed drains within 300 feet of any levee must be approved by the Indiana Flood Control and Water Commission. Plans may be made for the construction of culverts or bridges or the improvement of existing ones where drains will cross public highways or railroad right-of-ways. The construction of drains shall not prevent owner ingress or egress to his land via proper crossings. The connection of private drains with legal drains must be approved by the Stream Pollution Board. (McDonough-Florida)
W70-00595

INDIANA DEEP WATERWAYS COMMISSION.
Ind Ann Stat sec 68-201 (1961).

Descriptors: *Administrative agencies, *Indiana, *Great Lakes, *Atlantic Ocean, Canals, Federal government, St. Lawrence River, St. Lawrence Seaway, Legislation, Legal aspects, Projects, Project planning.

The Indiana Deep Waterways Commission is created, consisting of three members who are appointed by the governor. The purposes of the Commission are: (1) to investigate the subject of connecting the Great Lakes with the Atlantic Ocean via the Welland Canal and the St. Lawrence River; (2) to cooperate with other bodies and commissions created for that purpose; and (3) to urge upon Congress the enactment of legislation to promote such purpose. (Keith-Florida)
W70-00596

THE PROPOSED SOLWAY FIRTH BARRAGES: A REVIEW OF THE GEOLOGICAL AND GEOTECHNICAL ASPECTS,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
J. A. Kay.
Eng Geology, Vol 3, No 4, p 265-306, Oct 1969. 42 p, 12 fig, 8 tab, 64 ref.

Descriptors: *Dams, *Water supply, *Estuaries, Hydrologic data, Geology, Hydrogeology, Stratigraphy, Engineering geology.
Identifiers: England, Solway, Firth.

Barrages are proposed to create freshwater lakes in Solway Firth, England. The specific geology of each of the proposed sites is reviewed and the inadequacy of present information emphasized. Geotechnical problems which might arise during and after construction of the barrages are summarized. The possible sources of various types of constructional materials are indicated. Finally, methods are suggested which would provide much of the information essential for an accurate assessment of the various proposals for the area. (Knapp-USGS)
W70-00646

DETERMINATION OF DEPENDENCE BETWEEN FILTRATION CHARACTERISTICS OF DRAINAGE CANALS (IN RUSSIAN),
Akademiya Nauk Gruzinskoi SSR, Tiflis.
S. V. Meunargiya.
Published in Russian with English and Georgian summaries. Soobshch Akad Nauk, Gruz SSR, Vol 54, No 1, p 157-160, Apr 1969. 4 p, 5 fig, 1 tab, 3 ref.

Descriptors: *Drainage engineering, *Canal seepage, *Canals, *Filtration, Drainage water, Model studies, Water loss, Discharge (Water), Electrical studies, Parametric hydrology, Mathematical models.
Identifiers: *USSR, Georgia, SSR, Drainage canal characteristics.

The filtration characteristics of drainage canals were investigated with experimental models using the principles of electrical engineering and a mathematical formula. Several graphs giving the main filtration parameters of drainage canals can be readily obtained by using electromodeling methods, and can be successfully applied for the evaluation of actual filtration parameters of drainage canals. (Gabriel-USGS)
W70-00663

APPARATUS FOR TEMPERATURE MEASURING IN THE STUDIES OF DISCHARGES BY WATER PUMPS, USING THERMODYNAMICAL METHOD (IN FRENCH),
Central Creil Exploitation Service (France); and Departments of Tests and Thermal Studies (France).
J. Chaleil, and H. Procaccia.
L'Eau, No 7-8, p 327-336, July-Aug 1969. 10 p, 9 fig, 2 tab.

Descriptors: *Water temperature, *Water yield, *Instrumentation, *Mathematical studies, *Pumping, *Thermodynamics, Electrical equipment, Pressure, Energy, Energy transfer.
Identifiers: Pump discharge.

This article develops the application of the principles of thermodynamics for the evaluation of water-pump discharges and gives a detailed

description of the instruments used for measuring water temperature. Discharge data obtained by using the thermodynamic methods are compared with those from classical methods. The final data obtained by these two methods are not identical. (Gabriel-USGS)
W70-00679

RIVER AND HARBOR IMPROVEMENTS.

33 USCA secs 558C, 565, 567B (1957).

Descriptors: *United States, *Rivers and Harbors Act, *Easements, *Interstate compacts, Navigable rivers, Right-of-way, Federal government, State governments, Flood control, Pollution abatement, Administrative agencies, Legislation, Legal aspects, Tennessee Valley Authority Project.
Identifiers: Secretary of the Army.

The Secretary of the Army is authorized to grant easements for rights-of-way across lands acquired by the United States for river, harbor, and flood control improvements, provided that such rights-of-way shall be granted only upon the Secretary's finding that the same will be in the public interest and will not substantially injure the interest of the United States. Such rights-of-way may be annulled by the Secretary for failure to comply with the terms of the grant. The Secretary's authority does not extend to lands held by the Tennessee Valley Authority. Any persons or corporations may improve, at their expense, any navigable river upon the approval of plans therefor by the Secretary and by the Chief of Engineers of the Army. Such plan must conform with the general plan of the government improvements and must not impede navigation. Congressional consent is given to Maryland, West Virginia, Virginia, Pennsylvania, and the District of Columbia to form a compact to create a Potomac Valley Conservancy District and to establish an Interstate Commission on the Potomac River Basin. No right or jurisdiction of the United States in this area is to be affected thereby. (Carruthers-Florida)
W70-00696

IRRIGATION IN THE AMU-DAR'YA BASIN: PROGRESS REPORT,
For primary bibliographic entry see Field 03F.
W70-00705

DRAINAGE DISTRICTS UNDER 1911 ACT.

SC Code Ann secs 18-291 thru 18-303, 18-311 thru 18-323 (1962).

Descriptors: *South Carolina, *Drainage districts, *Financing, *Administrative agencies, State governments, Local governments, Federal government, Legal aspects, Legislation, Costs, Government finance, Governments, Assessments, Evaluation, Taxes, Value, Cost allocation, Cost sharing, Bonding.

Land is classified and assessed according to the degree by which it is benefitted by the proposed improvements. Total assessments exceeding twenty-five cents per acre are financed by bond issue after appropriate notice to landowners within the district and expiration of a period during which they may contest the issue. The drainage districts cooperate with the United States Government and may turn drainage work over to the latter on occasion. (Johnson-Florida)
W70-00715

CONOBRE V FRITSCH (NATURAL WATERCOURSES).
111 NE2d 38-41 (Ct App Ohio 1952).

Descriptors: *Ohio, *Watercourses (Legal), *Closed conduit flow, *Obstruction to flow, Spring waters, Judicial decisions, Streamflow, Pipes, Tiles, Swimming pools, Subsurface waters, Underground, Water sources, Channel flow, Channels, Farms, Farm ponds, Diversion, Pipe flow, Natural flow, Overland flow, Subsurface flow.

Plaintiffs sought to enjoin the owners of a farm, on which a stream originated from an underground spring, from obstructing, diverting, or diminishing the flow of water from the stream on the ground that the stream was a natural watercourse. The plaintiff owned a commercial swimming pool which utilized water from the stream. The issue was whether such spring and its consequent overflow into a channel, even though for a great part of its distance encased in tile pipe, created a natural watercourse. The court held that such spring and stream did constitute a natural watercourse and that the parties had only such rights as are given to riparian owners. The court noted that the stream, encased in the tile pipe, had run in the same direction for more than fifty years. 'Watercourse' was defined as a stream, usually flowing in a particular direction in a definite channel, having a bed, banks, or sides and discharging into some other stream or body of water. The injunction was granted. (Marsee-Florida)
W70-00720

SOIL AND WATER CONSERVATION DISTRICTS LAW.
For primary bibliographic entry see Field 03F.
W70-00736

ILLINOIS DRAINAGE CODE.
For primary bibliographic entry see Field 06E.
W70-00737

WEST CENTRAL MISSISSIPPI WATERWAY COMMISSION.
For primary bibliographic entry see Field 06E.
W70-00738

DRAINAGE DISTRICTS UNDER 1911 ACT: ORGANIZATION, POWERS AND EMPLOYEES OF COMMISSION; FEES, ETC.
SC Code Ann secs 18-251 thru 18-258 (1962).

Descriptors: *South Carolina, *Administrative agencies, *Drainage districts, *State governments, Governments, Legislation, Legal aspects, Local governments, Financing, Costs, Government finance, Administrative costs.
Identifiers: Levee districts.

After a drainage district is established, the clerk of the court appoints three members to the Board of Drainage Commissioners from the top three candidates for the post in an election within the local drainage or levee district. The Board shall possess those powers usually possessed by a corporation, including the right to hold and convey property and to sue and be sued. (Johnson-Florida)
W70-00759

LAWS OF FLORIDA GOVERNING WATER USE,
For primary bibliographic entry see Field 06D.
W70-00769

NORTH CAROLINA AND OTHER ATLANTIC STATES,
For primary bibliographic entry see Field 06E.
W70-00770

RIGHTS OF WAY FOR DRAINAGE.

SC Code Ann secs 18-51 thru 18-58 (1962).

Descriptors: *South Carolina, *Drainage, *Ditches, *Surface drainage, Damages, Legal aspects, Surface waters, Drainage practices, Drainage systems, Water control, Surface runoff, Legislation, Land development, Land management, Land use, Distribution systems, Excavation, Compensation, Construction, Adjudication procedure.

Any person who owns lands which can only be drained over the land of another is allowed under certain circumstances to enter the property of such owner and construct or cut such waterway as is necessary for this purpose. Provisions are included to deal with objections of the adjacent landowner to such construction. Each landowner selects a referee to represent his interests in the dispute. The two referees so appointed will select a third, and the three of them will have authority to fix the location and just compensation for such waterway by a written verdict. Appeal from their decision lies in magistrates' courts. Right to open and repair such waterway commences immediately upon payment of the compensation thus ascertained. Failure of the adjacent owner to appoint a referee allows the referee appointed by the person seeking to construct the waterway to proceed by himself as if all three were meeting. (Johnson-Florida)
W70-00775

THE WANDERING MISSOURI RIVER: A STUDY IN ACCRETION LAW,
For primary bibliographic entry see Field 06E.
W70-00777

THE WANDERING MISSOURI RIVER: A STUDY IN ACCRETION LAW,
For primary bibliographic entry see Field 06E.
W70-00778

THE WANDERING MISSOURI RIVER: A STUDY IN ACCRETION LAW,
For primary bibliographic entry see Field 06E.
W70-00779

COMPENSATION FOR TAKING OF FLOWAGE EASEMENTS BY CONDEMNATION,
Robert Corontzos.
Mont L Rev, Vol 23, No 2, p 212-221, Spring 1962. 10 p, 78 ref.

Descriptors: *Easements, *United States, *Compensation, *Condemnation, Judicial decisions, Legal aspects, Eminent domain, Federal government, Land use, Real property, Dams, Property values, Adjudication procedure.
Identifiers: *Flowage easements.

The case of United States v Virginia Electric and Power Company, 365 U S 624 (1961), dramatically presented the problem of determining whether or not flowage easements are 'private property', the taking of which requires just compensation. However, in the instant case, the court did not discuss the problem as involving any question of whether or not 'property' as such was present, but rather based its discussion solely on considerations of 'valuation'. Courts have been asked on numerous occasions to define 'property' under particular fact situations. Under the fifth amendment, 'property' has been held to be a group of rights inhering in a citizen's relations with others which results in certain powers over a physical thing. Whether there is a taking must be determined in light of the particular facts and circumstances involved. A private easement has generally been held to be 'property' in the constitutional sense. The holder must have a real interest in the property. Qualified rights must be considered in light of the qualifying conditions under which they exist. A careful reappraisal of the problems involved in this area should be undertaken by the judiciary. (Heckerling-Florida)
W70-00781

INTERSTATE COOPERATION IN RIVER BASIN DEVELOPMENT,
For primary bibliographic entry see Field 06B.
W70-00784

PUBLIC RIGHT AND THE RULE OF NO COMPENSATION,
Robert R. Rossi.
Notre Dame Lawyer, Vol 44, No 2, p 236-251, Dec 1968. 16 p, 112 ref.

Descriptors: *Compensation, *Navigation, *Riparian rights, *Eminent domain, Riparian waters, Water rights, Navigable waters, Obstruction to flow, Reasonable use, Water law, Navigable rivers, Bridges, Dams, Damages, Federal government, State governments, Judicial decisions, Legal aspects.
Identifiers: *Navigation servitude.

Riparian owners are injured when downstream obstacles, constructed with legislative authorization, cutoff their navigation rights. Historically, riparians have had the rights of access to the adjacent navigable waters and of navigation. Present case law denies the riparian normal eminent domain compensation for interference with these rights by characterizing 'access' as a compensable private right and 'navigation' as a non-compensable public right. Although liberalizing influences have attempted to construe obstructions to access to navigable waters as compensable, courts are reluctant to find a constitutional 'taking' unless the obstruction causes damages to the riparian different in kind and degree than that sustained by the general public. Further, the concept of the navigation servitude permits the taking of private property (access) without compensation in exercise of the navigation power. This rule is followed by state and federal governments in the construction of bridges and dams in aid of navigation. Critics of this rule analogize the stranded riparian's situation with that resulting from a highway access taking. Yet compensation is allowed for the latter. Federal and state legislation allowing compensation seems the only viable solution for the injured riparian owner. (McDonough-Florida)
W70-00785

COMMISSIONERS OF HEALTH AND DRAINAGE IN CERTAIN COUNTIES.

SC Code Ann secs 18-71 thru 18-76 (1962).

Descriptors: *South Carolina, *Drainage, *Administrative agencies, *Local governments, Ditches, Damages, Legal aspects, Surface drainage, Surface waters, Drainage practices, Legislation, Water control, Drainage systems, Water pollution, Water pollution control, Relation, Estimated costs, Assessments, Compensation, Public health.

The governing bodies of enumerated counties may act as commissioners of health and drainage. Such commissioners hear arguments and decide upon just compensation in disputes where a landowner desires to drain his land by cutting a necessary outlet through adjoining lands. When a third of the landowners upon a watercourse desire to drain their lands into such watercourse, the commissioners have authority to let contracts for accomplishment of this purpose and levy assessments apportioned according to the amount of benefit received by each landowner. If a watercourse is deemed unsanitary and a hazard to public health, the commissioners may proceed to drain the watercourse after receiving estimates of the cost. If the expense involved is greater than a reasonable assessment to the landowners, the commissioners may petition the judge of the circuit court and upon his approval pay the excess costs from the county revenue. (Johnson-Florida)
W70-00788

RIPARIAN RIGHTS IN ARTIFICIAL LAKES AND STREAMS,
Alvin E. Evans.
Mo L Rev, Vol 16, No 2, p 93-117, Apr 1951. 25 p, 99 ref.

Descriptors: *Missouri, *Riparian rights, *Artificial watercourses, *Judicial decisions, Streams, Lakes, Dams, Prescriptive rights, Boating, Channels, Beds, Fishing, Recreation, Water law, Impounded waters, Obstruction to flow, Drainage, Watercourses (Legal), Diversion, Overflow, Ditches, Water supply, Flooding, Accretion (Legal aspects), Alteration of flow.
Identifiers: *Estoppel, *Reciprocal easements, Implied consent, Statute of limitations.

The situations where an owner of land bordering on a stream or lake erects a dam and floods the lands above and where a natural stream is diverted from its original channel into a new one are considered in this article. The subject of inquiry is the riparian rights which may or may not accrue to the owners of land bordering on artificially created lakes and watercourses; the subject is approached through an analysis of judicial decisions dealing with the subject. The courts use three different rationales in finding riparian rights in these cases: (1) if an artificial lake or watercourse is maintained for a sufficient length of time, it should be regarded as natural; (2) each party acquired rights in the property of the other by a similar course of conduct, adverse usage or prescription (the theory of resulting reciprocal easements); and, (3) the plan inaugurating the flowage is deemed to have grown out of mutual understanding and assent (the theory of estoppel). The author concludes from his case analysis that while most jurisdictions find riparian rights where they should, the rationale for the decisions is often poor. (Keith-Florida)
W70-00797

NAVIGABLE WATERS--RIGHT OF RIPARIAN OWNER TO ARTIFICIAL ACCRETION,
Marion W. Smith.
Miss L J, Vol 25, No 2, p 174-175, Mar 1954. 2 p, 10 ref.

Descriptors: *Alabama, *Accretion (Legal aspects), *Riparian land, *Federal government, Avulsion, Judicial decisions, Riparian rights, Dredging, Legal aspects, Boundaries (Property), Beds, Beds under water, Landfills, Land forming, Land, Shores, Boundary disputes, Channel improvement, Land classification, Governments.

The Alabama Supreme Court ruled in State v Bill, 66 So 2d 141 (Ala 1953) that title to fifty-six acres of land, created by dredging and piling against the riparian owner's shoreline, was in the riparian owner because of the doctrine of accretion. At common law, accretion had to be gradual and imperceptible. In this instance it was man-made, rapid and perceptible. The court ruling conflicts with both the common law doctrine of avulsion and established case law which would have vested title in the sovereign. The result, although just, should not have been reached upon the basis of accretion because it was neither gradual nor imperceptible. (Darragh-Florida)
W70-00798

COMMON LAW RIGHTS TO SURFACE WATERS,
Robert S. Stewart.
Notre Dame Lawyer, Vol 21, No 4, p 364-366, June 1946. 3 p, 9 ref.

Descriptors: *Surface waters, *Drainage water, *Repulsion (Legal aspects), *Riddance (Legal aspects), Runoff, Standing waters, Surface runoff, Ditches, Drainage, Drainage systems, Drains, Relative rights, Diversion, Retention, Channels, Land, Overland flow, Rain water, Surface drainage, Water sources, Hydrology, Running waters, Wetlands.

Surface waters are waters that fall from the skies or arise in springs. They diffuse themselves over the surface of the ground following no defined course or channel and are lost by diffusion, percolation, evaporation, or natural drainage. Under the civil law rule, as between upper and lower ground owners, the lower proprietor's land was subject to an easement of natural surface water flow from the upper proprietor's land. Under the common-law rule, a landowner may control both the water falling on his land and that flowing across it. He may refuse to receive water originating on, or flowing over, adjoining property. The retention, diversion, repulsion, or altered transmission of surface water is not actionable even though damage ensues. Courts have often modified the common-law rule to fit each individual case. Some courts have stated that the upper proprietor may not accumulate surface water in a ditch or drain and thereby increase the flow and discharge onto the lower estate; nor may the proprietor change the direction of such water. The true common-law rule seems preferable since modifications of the rule create confusion. (Marsee-Florida)
W70-00799

STATUTES-EXTENT OF THE AUTHORITY OF THE DEPARTMENT OF CONSERVATION.
Tul L Rev, Vol 21, No 3, p 504-507, Mar 1947. 4 p.

Descriptors: *Louisiana, *Leases, *Administrative agencies, *Legislation, Conservation, Judicial decisions, Remedies, Dredging, Contracts, Administrative decisions, Shellfish, Natural resources, State governments, Lakes, Riparian rights, Legal aspects, Relative rights, Oysters, Clams.
Identifiers: Injunctions (Mandatory).

In the case of Gorham v Mathieson Alkali Works, 27 So 2d 299 (La 1946), plaintiffs, riparian owners brought suit to enjoin defendant from dredging the bottoms of various lakes. The defendant had been given a lease under a contract from the Department of Conservation to remove oysters and clam shells from the lake bottoms. Plaintiffs contended there was no statutory authority to grant the lease. The appellate court, reversing the trial court, held that the Department did have authority to grant the contracts of lease. The Department was created to protect, manage, and conserve the natural resources of the state. The language of the act is broad but alone does not give the Conservation Commission the right to sell or lease any natural resources. However, when read in conjunction with a 1914 act, which gives the Commission both the right to sell and grant the privilege of taking oyster shell deposits from Gulf Coast waters and the right to make contracts leasing the right to remove such shell deposits, the contracts to lease in the instant case come within the authority granted by statute. (Heckerling-Florida)
W70-00800

CONSTITUTIONAL LAW-NAVIGABLE WATERS-EXTENSION OF THE FEDERAL PREROGATIVE,
Orton A. Jones.
W Va L Rev, Vol 63, No 1, p 59-62, Dec 1960. 4 p.

Descriptors: *West Virginia, *Navigable rivers, *Federal-state water rights conflicts, *Federal jurisdiction, Non-navigable waters, Legal aspects, Hydroelectric plants, Federal government, Oklahoma, Flood control, Regulation, Navigation, Judicial decisions, United States, Watersheds (Basins), Eminent domain, Public benefits, Federal project policy, Federal reclamation law, Compensation, Hydroelectric power, Condemnation value, Jurisdiction, State jurisdiction, Tributaries.
Identifiers: *Hydroelectric franchises, Due process, Grand River, Arkansas River.

In United States v Grand River Dam Authority, 80 S Ct 1134 (1960), the federal government instigated a hydroelectric project on a non-navigable tributary of a navigable river; the project was in a location for which a state agency held a hydroelectric franchise. When the agency demanded compensation for the taking of its rights, the Court of Claims held the government liable. The Supreme Court reversed and held that there is no taking of property when the United States asserts jurisdiction to regulate navigable streams, and federal jurisdiction extends to non-navigable tributaries of navigable streams. The history of the expanding federal jurisdiction over 'navigable waters' is traced

through an analysis of judicial decisions. Three conclusions follow from the case analysis: (1) the expansive nature of federal jurisdiction in the area is a function of the successive definitions of the term 'navigable waters'; (2) the Grand River case extended jurisdiction from non-navigable portions of a navigable stream to non-navigable tributaries of a navigable stream; and (3) the Grand River case indicates a trend toward a rule that would afford the federal government a prerogative over all streams that could be classified as the watershed of a navigable waterway. (Keith-Florida)
W70-00801

WATERS AND WATERCOURSES - EASEMENTS - IMPLIED DEDICATION OF FLOWAGE EASEMENT APPURTENANT TO A DAM,
James S. Moore, Jr.
Tex L Rev, Vol 34, No 3, p 493-494, Feb 1956. 2 p.

Descriptors: *Minnesota, *Easements, *Water level fluctuations, *Impounded waters, Judicial decisions, Watercourses (Legal), Legal aspects, Dams, Lakes, Legislation, Water law, Overflow, Condemnation, Flood control, Conservation, Recreation, Flooding, Texas, Variability, Flow characteristics.
Identifiers: *Flowage easements, *Implied dedication, Easement by prescription, Common-law dedication.

In State v Fischer, 71 NW 2d 161 (Minn 1955), the defendants' lands had been continually flooded for over fifteen years by public lake waters impounded by a dam. The State of Minnesota sued to establish a flowage easement by implied dedication, relying in part on a state statute. The defendants offered evidence that water levels had fluctuated during the fifteen-year period. The trial court found a flowage easement in the state and the state supreme court reversed. The standard requisites for common-law dedication of an individual's land to the state are the landowner's expressor implied consent to dedicate to the public use and the public's acceptance through its use. One court and the Minnesota Legislature have attempted to supplement the common-law principles of dedication by stating that a set number of years continuous flowage by public waters is conclusive evidence of dedication. The problem incurred with such supplementation is that it does not achieve the desired result of easing the state's burden of proof in cases where the water level fluctuates; this is because dedication, as construed by the courts, applies only to that land continuously flooded. (Keith-Florida)
W70-00802

RIPARIAN RIGHTS - RIGHT TO FOLLOW ACCRETIONS ACROSS FIXED BOUNDARY LINE.

Tenn L Rev, Vol 19, No 6, p 862-864, Feb 1947. 3 p, 10 ref.

Descriptors: *Tennessee, *Accretion (Legal aspects), *Erosion, *Riparian rights, Legal aspects, Judicial decisions, Mississippi River, Channels, Bank erosion, Riparian land, Boundaries (Property), Banks, Relative rights, Severance, Boundary disputes, Navigable rivers.
Identifiers: *Riparian owners, *Non-riparian owners.

Plaintiff was the riparian owner of a tract on the Mississippi River; defendant was the non-riparian owner of a tract adjacent and upland to that of the plaintiff. The plaintiff's land completely eroded away and by 1917 the defendant had become a riparian owner. When the process of accretion returned the two tracts of land to their pre-erosion status, the plaintiff brought an action of ejectment. The court held that when land originally non-riparian becomes riparian because of erosion, the now riparian landowner becomes vested with the rights of a riparian owner and entitled to all accretions to his ripa even though such accretions extend across a fixed boundary line and occupy a space which was once that of another. The courts of this country follow the general rule that riparian owners are entitled to additions to their land caused by the process of accretion, but there is conflict among states when the accretions cross a boundary line and cover an area formerly held by another and lost by him due to erosion. The Connecticut rule, which represents the weight of authority, is that accretions belong to the ripa to which they attach. (Keith-Florida)
W70-00803

EQUAL FOOTING AND THE MARGINAL SEA,
Jack C. Terry.
U Kansas City L Rev, Vol 19, p 66-71, 1967. 6 p, 50 ref.

Descriptors: *Federal government, *California, *Louisiana, *Texas, Judicial decisions, Subsoil, Low water mark, Ownership of beds, Tidal waters, High water mark, Oil, International waters.
Identifiers: *Marginal sea, Tidelands, Constitutional law.

The United States Supreme Court has decided three cases involving the question of ownership of subsoil under the marginal sea off the coasts of California, Louisiana, and Texas. All three cases were decided in favor of the United States rather than the adjacent states involved. The land in question lies between the low tide mark on the beaches and the three mile United States territorial limit. This land is now of considerable value due to oil discoveries. This comment deals with the Texas appeal for a rehearing. Texas contended that it should be treated differently from the other states because it was an independent nation prior to admission to the Union. This theory was not accepted because Texas was admitted to the Union on an equal footing with the original states in all respects. (Watson-Florida)
W70-00804

CANALS AND WATERWAYS.

Ill Ann Stat ch 19, secs 8-37.24 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Illinois, *Regulation, *Canals, *Transportation, Michigan, Legislation, Administration, Open channels, Ditches, Drains, Inland waterways, Locks, Navigation, Dams, Riparian rights, Docks, Drains, Banks, Navigable waters, Obstruction to flow, Administrative agencies, Legal aspects.
Identifiers: Penalties.

The powers and duties of the Illinois Department of Public Works and Buildings with relation to the Illinois and Michigan canal, including its feeders, basins, and property including locks, dams, and navigation improvements of the Illinois and Little Wabash rivers are set forth. Rules and regulations regarding tolls and navigation as well as leasing and selling provisions concerning land, ice harvesting, and riparian rights are included. The Department shall establish title to the canal lands in the state and keep the canal, locks, and dams in good condition. No drains or ditches may be dug or sand or gravel taken without the Department's consent when such action causes injury to the canal. No wharves may be constructed or the banks of the canal used without the Department's consent. The lock gates shall not be interfered with and the canal's use may not be interfered with. No bridge may be constructed over the canal without the approval of the Department. The canal is abandoned as a carriage for commerce. Canal lands not needed for public purposes shall be sold. (Moulder-Florida)
W70-00814

ILLINOIS DRAINAGE LAW (A COMMENTARY),
Illinois State Bar Association.
Donald V. Dobbins.
39-42 Ill Ann Stat XIX-XXXV (Smith-Hurd 1956).

Descriptors: *Illinois, *Drainage districts, *Drainage systems, *Administrative agencies, Legislation, Drainage, Drainage programs, Drains, Ditches, Levees, Natural flow doctrine, Repulsion (Legal aspects), Assessments, Construction, Costs, Right-of-way, Condemnation, Local governments, Water law.
Identifiers: Subdistricts.

While repealing previous acts, the Illinois Drainage Code of 1955 retains the classifications and organization of drainage districts established under the 1879 Levee Act and the 1885 Farm Drainage Act. Those acts authorized the establishment of drainage and levee districts, mutual districts, outlet districts, one township districts, union districts, special districts, and river districts to be governed by commissioners. The Code grants exclusive jurisdiction over the organization and operation of all districts to the county court for the county wherein the district lies, but retains the same commissioner structure. The Code specifies methods for organizing new districts. Assessments for drainage district costs are characterized as original, annual maintenance, and additional and are assessed by the individual districts upon county court approval. Commissioners' general powers under the code include specific powers to: (1) obtain rights-of-way by agreement or condemnation; (2) enter into contracts for district purposes; (3) establish an emergency operating fund; (4) issue notes and bonds of the district; and (5) incur other debts. The Code allows detachment of lands from a district for storm drainage purposes, and permits annexation of lands to existing districts. (McDonough-Florida)
W70-00815

ISLANDS AND ABANDONED RIVER CHANNELS.

Iowa Code Ann secs 568.1-568.25 (1950), as amended, (Supp 1969).

Descriptors: *Iowa, *Beds, *Ownership of beds, *Islands, Legislation, River beds, Stream beds, Banks, Navigable rivers, Rivers, Dry beds, Channels, Boundaries (Property), Surveys, Appraisals, Leases, State governments, Boundary disputes, Land tenure, Legal aspects.

Upon application to the Secretary of State by the county auditor or a prospective purchaser land, bars, or islands in channels of abandoned and unusable navigable streams may be sold. The Secretary may order a survey of the land by the county surveyor, or he may use a prior recorded survey. Three disinterested freeholders are appointed to appraise the land. First purchase rights are reserved for a person who has occupied the land as a home for at least three years, upon prompt filing of an application. Otherwise the land is sold by advertised bids for not less than the appraised value. If no applications or bids are received, the land may be leased, at the end of which period it is re-advertised for sale. If such lands are in the possession of any person, company, or corporation that has claimed ownership for over ten years and has paid taxes and made valuable improvements, they may be sold to said claimant. The Attorney General must first quit title and determine the value of the land by filing suit in the district court. River islands may be sold or leased after survey and appraisal. (Douberley-Florida)
W70-00817

LEVEES.
Ky Rev Stat Ann secs 266.010-266.990 (1963).

Descriptors: *Levees, *Kentucky, *Regulation, *Administrative agencies, Legislation, Eminent domain, Engineering structures, Local governments, Adjudication procedure, Administrative decisions, Easements, Equitable apportionment, Judicial decisions, Compensation, Construction costs, Assessments, Loans, Maintenance costs, Taxes, Decision making, Legal aspects, Planning, Financing.

The establishment of levees by the county court in any county in Kentucky when it is conducive to the public welfare or public utility is provided for. Upon petition setting forth the necessity for a levee, the court shall appoint impartial commissioners to study the proposed plans and make specific recommendations in a report. Details of this report and the procedure for exceptions to the proposed levee are outlined. If the plans are approved, a board of five levee commissioners is appointed by the court. The term, method of election, bond, and compensation of the board are provided. The board's duty to superintend the construction, care, and protection of the levee is detailed, and powers are given to perform these duties. These include power to enter agreements with the federal government, acquire land, levy an annual tax, borrow funds, issue bonds, and make any other additional assessments. All lands in the levee district are subject to a lien for the costs of the levee. Fines for violations of provisions in the chapter are provided. (Schram-Florida)
W70-00818

LEVEES.
Ky Rev Stat Ann secs 266.010-266.110 (1963).

Descriptors: *Levees, *Kentucky, *Administrative agencies, Legislation, Eminent domain, Engineering structures, Local governments, Adjudication procedure, Administrative decisions, Easements, Equitable apportionment, Judicial decisions, Compensation, Construction costs, Assessments, Loans, Taxes, Maintenance costs, Decision making.

This chapter enables the county court in counties of less than 200,000 population to establish and aid in the construction of any levee along a river or watercourse within or bounding the county. A petition, signed by five landowners, setting forth the necessity for the levee and sufficient surety bond are required. Upon filing the petition, the county court shall appoint three impartial commissioners who shall: (1) survey the proposed site of the levee; (2) ascertain the names of the owners and tenants of the land; (3) assess a just compensation for the land required for the levee; and (4) make a signed written report to the court setting forth this information with a map of the proposed route of the levee. If the report is favorable, the court shall issue process against the required land. If exceptions are filed, there shall be a trial and, if needed, an appeal on the issues. If the court decides that the levee should be established, it shall so order, and every four years thereafter appoint a board of five levee commissioners who are resident landowners of the vicinity of the levee. (Schram-Florida)
W70-00819

LEVEES.
For primary bibliographic entry see Field 06E.
W70-00820

DRAINAGE AND RECLAMATION ACT OF 1912.
Ky Rev Stat Ann secs 267.010-267.990 (1963).

Descriptors: *Kentucky, *Drainage programs, *Reclamation, *Drainage districts, Legislation, Multiple-purpose projects, Drainage, Surface drainage, Ditches, Drainage engineering, Land reclamation, Canals, Drains, Administrative agencies, Coordination, Decision making, State governments, Water policy, Water law, Eminent domain, Assessments, Tax rate, Maintenance, Construction.

This act empowers any county court to establish and have constructed any ditch, drain, or canal for the purpose of draining low, swampy, or overflowed land. Broad powers are distributed among the court, a board of viewers, drainage district directors, and county drainage commissioners. These powers include taxation and the right of eminent domain. The act contains numerous procedural details covering bonding, organization of districts, assessments, and collections. Specific powers are granted to each of the supervisory boards in relation to methods of hiring, construction, and maintenance. In addition, such board's duties are outlined in detail. Financing methods are discussed in detail and include the right to place liens against the land within each drainage district to insure payment of assessments. Finally, provisions for establishing and organizing districts are stipulated. (Schram-Florida)
W70-00821

DRAINAGE AND RECLAMATION ACT OF 1912.
Ky Rev Stat Ann secs 267.010-267.240 (1963).

Descriptors: *Kentucky, *Drainage programs, *Reclamation, *Drainage districts, Legislation, Multiple-purpose projects, Drainage, Surface drainage, Ditches, Drainage engineering, Land reclamation, Canals, Drains, Administrative agencies, Coordination, Decision making, State governments, Water policy, Water law, Eminent domain, Assessments, Tax rate, Maintenance, Cost-benefit analysis, Construction.

Power is given to any county court to have constructed a ditch, drain, or canal to reclaim swampy or overflowed land upon petition by landowners in the affected area. Procedural provisions, such as bonding, a board of viewers to examine and report on feasibility, and confirmation, are outlined. Upon a favorable report from the board of viewers, a board of directors and a drainage district are to be established. The commissioners, consisting of directors from each district have the power to acquire land and any other powers necessary to carry out the provisions of this chapter, including eminent domain. A drainage engineer is to be hired to map, profile, and plan the needed construction. The board of viewers is given the power to classify and assess land within the district and to determine the rate of assessment. Additional provisions including estimates of cost, assessments of benefits, and assessment of compensable damages are outlined. The court is to keep a record of all drainage within the district, certified by the county clerk. (Schram-Florida)
W70-00822

DRAINAGE AND RECLAMATION ACT OF 1912.
Ky Rev Stat Ann secs 267.250-267.330 (1963).

Descriptors: *Kentucky, *Drainage programs, *Reclamation, *Drainage districts, Legislation, Multiple-purpose projects, Drainage, Surface drainage, Ditches, Drainage engineering, Land reclamation, Canals, Drains, Administrative agencies, Coordination, Decision making, State governments, Water policy, Water law, Eminent domain, Assessments, Tax rate, Maintenance, Condemnation, Construction, Financing.
Identifiers: *Bonds.

Payment for work done under this chapter is to be made in monthly installments. When it is necessary for the purposes of this act, contractors shall have the right of access and power to remove certain obstructions. Methods of construction when an improvement crosses railroad property are set forth. When the purchase of land needed for a right of way is not possible, procedures for condemnation are proposed. Details for an assessment role, including the statement of costs, what the role shall include, and provisions for hearings on the role and statement are outlined. Additional provisions are made for payment and collection of assessments when it averages less than twenty-five cents per acre. When the average assessment is more than this amount, bonds are authorized, and failure to pay the assessment is consent to the bonds. In addition, procedures are outlined for issuance and sale of these bonds and collection of assessment installments. (Schram-Florida)
W70-00823

DRAINAGE AND RECLAMATION ACT OF 1912.

Ky Rev Stat Ann secs 267.340-267.500 (1963).

Descriptors: *Kentucky, *Drainage programs, *Reclamation, *Drainage districts, Legislation, Multiple-purpose projects, Surface drainage, Drainage, Ditches, Drainage engineering, Land reclamation, Canals, Drains, Administrative agencies, Coordination, Decision making, Water policy, Water law, Maintenance, Assessments, Financing, Obstruction to flow.

Either the board or the county court is empowered to change assessments and relevy to cover any deficit caused by unforeseen circumstances. Liability of successors in title and contribution for joint owners are provided. Provisions for liens of assessments and enforcement of same are provided. Maintenance procedures are outlined and provisions for hiring of a drainage superintendent and an attorney for the board are made. Financial details are dealt with and it is provided that expenses should be apportioned among the districts. Landowners may use these improvements as an outlet for lateral drains. Natural drains which receive water from the public drains and ditches in this section are to be under the control of the act as extensions of the public ditch. Any obstructions or damage caused by adjoining landowners will be charged to them. Provisions for a drainage commissioner and board of supervisors in counties having seventy-five or more districts are outlined. Procedures for establishing separate districts are also included. (Schram-Florida)
W70-00824

DRAINAGE AND RECLAMATION ACT OF 1912.
Ky Rev Stat Ann secs 267.520-267.990 (1963).

Descriptors: *Kentucky, *Drainage programs, *Reclamation, *Drainage districts, Legislation, Multiple-purpose projects, Surface drainage, Drainage, Ditches, Land reclamation, Canals, Drains, Administrative agencies, Coordination, Decision making, Water policy, Water law, Assessments, Tax rate.

The members of the district drainage board shall qualify and organize in the same manner as the county board. The powers and duties of the district board shall also be the same as the county board within its own district. They shall have full jurisdiction and control over the work provided for under the proceeding for which they were established. An amendment of the order establishing the district to change the name of any landowner or description of land can be made at any time. Drainage districts may be enlarged so as to include other contiguous land upon petition of the board to the county court. The fiscal court of any county shall retain control of improvements made by general taxation and may make appropriation to aid any drainage district within the county. A majority, either in amount or number, of those assessed for the maintenance of any improvement may petition for discontinuance of the improvement. (Schram-Florida)
W70-00825

FLOOD CONTROL ACT.
Ind Ann Stat 27-1101 thru 27-1109 thru 27-1134 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Administrative agencies, *Flood control, *Water resources development, Legislation, Floodways, Channel improvement, Flood plains, Multiple-purpose projects, Project planning, Planning, Administration, Cities, Floodwaters, Water resources, Taxes, Tax rate, Adjudication procedure, Obstruction to flow, Eminent domain, Loans, State governments, Appropriation, Drains, Levees.

To control floods and preserve Indiana's water resources, and to establish a comprehensive plan toward those goals, the Natural Resources Commission is granted enumerated powers and duties. There are provisions for cooperation by the Commission with federal and state agencies and for the establishment of floodways. Procedures are set forth for the removal and regulation of obstructions placed in floodways and for the approval of flood control works by the Commission. Orders of the Commission may be appealed. The act makes provision for appropriations to fulfill the purposes of the act, and the Flood Control Revolving Fund, from which loans are made to municipalities for the institution and accomplishment of flood control programs, is created. Flood control programs may be instituted by municipalities with the approval of the Commission and the State Board of Finance. Municipalities may levy annual taxes for flood control purposes. The act defines flood, flood water, flood flow, channel, flood plains, floodway, flood control, flood easement, and water resources. (Marsee-Florida)
W70-00827

FLOOD CONTROL ACT.
Ind Ann Stat 27-1101 thru 27-1103, 27-1109 thru 27 1117 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Administrative agencies, *Flood control, *Water resources development, Legislation, Floodways, Channel improvement, Flood plains, Multiple-purpose projects, Project planning, Planning, Administration, Cities, Floodwater, Water resources, Obstruction to flow, Eminent domain, Governments, State governments, Federal government, Regulation, Control, Surveys, Reservoirs.

To control floods and preserve Indiana's water resources, the Natural Resources Commission has the powers and duties to: (1) establish comprehensive plans for flood control and preservation of water resources; (2) require information from local officials; (3) utilize other state agencies and employ technical experts; (4) enter upon lands or waters for purposes of investigation; (5) conduct hearings; (6) exercise the power of eminent domain; (7) cooperate with state and federal agencies; (8) maintain actions to abate nuisances; (9) encourage local initiative in flood control; (10) grant easements and the rights to construct and operate flood control structures; (11) exercise jurisdiction over public and private waters for purposes of flood control; (12) grant or deny applications for obstructions to be placed in floodways and remove obstructions; (13) make surveys of water resources; and (14) obtain recommendations from the Department of Conservation water, flood flow, channel, flood plains, floodway, flood control, flood easement, and water resources. (Marsee-Florida)
W70-00828

FLOOD CONTROL ACT.
Ind Ann Stat secs 27-1118 thru 27-1134 (1960), as amended, (Supp 1968).

Descriptors: *Indiana, *Administrative agencies, *Flood control, *Water resources development, Legislation, Multiple-purpose projects, Administration, Taxes, Tax rate, Adjudication procedure, Loans, Governments, State governments, Financing, Appropriation, Floodways.

The Natural Resources Commission may establish any floodway as a commission floodway and may alter or terminate the same. All flood control works must be coordinated in design, construction, and operation and must be approved by the Commission. Persons affected by a Commission order relative to commission floodways or to the approval of flood control works may appeal to the courts as provided herein. Loans may be made to municipalities, for the purpose of accomplishing flood control programs, from the Flood Control Revolving Fund. Municipalities may institute and administer flood control programs, when approved by the State Board of Finance and the Commission, and may levy an annual tax on real and personal property for such purpose. No loan may be made to a municipality unless: (1) proper application has been made; (2) approval has been granted by the state Board of Finance and the Commission; and (3) assurance is given by the municipality that the flood control program will be satisfactorily maintained. The State Board of Finance and the Commission must ascribe to loan applicants a priority rating based on the need for a flood control program. (Marsee-Florida)
W70-00829

INTERSTATE DRAINS.
Ind Ann Stat secs 27-2601 thru 27-2606 (Supp 1968).

Descriptors: *Indiana, *Drainage programs, *Interstate commissions, *Local governments, Drainage, Cost sharing, Construction costs, Legislation, Construction, Drainage engineering, Benefits, Damages, Planning, Repairing, Administrative agencies, Assessments, Interstate compacts, Legal aspects.

Whenever proceedings are initiated in this or any adjoining state to construct or reconstruct a drain which will affect lands in both states, the county board of the county affected shall have authority to join the other state in the effort to construct such drain. Upon receipt of an offer from the other state or an acceptance of this state's offer, such board shall proceed to form an interstate board, electing a chairman and clerk from different states. The interstate board members from this state shall have half the votes of that board. The board may hire an engineer to work with the county surveyors. Upon receipt of a report, the Drainage Board of Indiana shall assess the benefits and damages to each tract of land in this state. Whenever improvement is established in both states and funds are available, the interstate board shall meet and let work contracts. (Smith-Florida)
W70-00830

DRAINAGE OF WATER FROM PUBLIC ROADS; AND REPAIR OF FLOOD DAMAGE TO CERTAIN ROADS.
For primary bibliographic entry see Field 06E.
W70-00832

BRIDGES - GENERAL PROVISIONS.
Miss Code Ann secs 8420-8434 (1956).

Descriptors: *Mississippi, *Bridges, *Culverts, *Bridge construction, Local governments, State governments, Gulf of Mexico, Construction, Construction costs, Financing, Planning, Project planning, Cost allocation, Legal aspects, Legislation, Highways, Condemnation.

All bridges and culverts hereinafter built or placed in state roads must be the full width of the crown of the roadway. The boards of supervisors of counties bordering on tidewaters of the Gulf of Mexico are empowered to provide illumination for bridges and other parts of public highways within their counties. The boards may further establish, operate, and maintain toll bridges or ferries on any part of a public road. The boards are empowered to purchase or to acquire by condemnation, privately-owned bridges where these link segments of public roads. The boards may purchase toll bridges, except for interstate or state operated bridges, and may maintain them in a toll-free status. Where a bridge is necessary between two or more counties, the boards of supervisors of the respective counties may join in such bridge's construction and financing. If no agreement can be reached, a single county board may construct and maintain the bridge, provided it secures the consent of the other counties involved. (Kelly-Florida)
W70-00833

4B. Groundwater Management

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 5 CONSUMPTIVE USE OF WATER: COMMON LAW RULES,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00532

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
For primary bibliographic entry see Field 05G.
W70-00542

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
For primary bibliographic entry see Field 05G.
W70-00543

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
For primary bibliographic entry see Field 05G.
W70-00544

THE MOVEMENT FOR NEW WATER RIGHTS LAWS IN THE TENNESSEE VALLEY STATES,
For primary bibliographic entry see Field 06E.
W70-00577

THE QANATS OF IRAN,
H. E. Wulff.
Scientific American, Vol 218, No 4, p 94-100; 105, 1968. 10 fig.

Descriptors: *Aqueducts, *Arid lands, *Water conveyance, *Water supply, *Aquifers, Irrigated land, Construction costs, Irrigation systems, Channels, Foreign construction, Irrigation operation and maintenance.
Identifiers: *Qanats, *Iran.

Most of Iran is arid, receiving only 6 to 10 inches of rainfall a year. Yet Iran is a farming country that grows its own food and also exports food and fiber. 75% of all water is provided by some 22,000 qanats - hand-dug underground channels that conduct water by gravity from highland aquifers to arable plains. This system was started some 3,000 years ago. This paper reviews the history of qanats, methods of construction, current problems of rising costs, and land reforms - all of which may bring about a switch to individual wells and pumps to meet new demands for irrigation water. (Crouse-Arizona)
W70-00692

NOTES ON PROBLEMS OF IRRIGATION IN THREE LIBYAN OASES,
Lars Eldblom.
Ekistics, Vol 23, No 137, p 199-202, 1967. 8 fig, 3 ref.

Descriptors: *Irrigation practices, *Arid lands, *Irrigated land, *Shallow wells, *Artesian wells, Water rights, Rotations, Land use, Water supply, Pumps.
Identifiers: *Oases, *Lybia, Land use pattern.

This paper presents findings at three irrigated oases in Lybia. Use of shallow, dug wells results in an irregular boundary and scattered gardens with long crop rotation periods. Artesian wells create a more compact structure with shorter rotations and thus, soil fertility problems. Water is drawn from most shallow wells by ancient lever (Khettera) or pulley (Dalou) devices. Engine driven pumps are used on some of the better wells, but are of limited economic value owing to restricted water supply,

high costs and maintenance problems. Use of pumps or enlargement of wells tends to raise problems regarding partition of land between already cultivated gardens. (Crouse-Arizona)
W70-00703

WATER SUPPLY, USE AND MANAGEMENT,
F. Dixey.
In E S Hills, Ed, Arid Lands: A Geographical Appraisal, London, Methuen, p 77-102, 1966. 13 fig, 49 ref.

Descriptors: *Water supply, *Water utilization, *Arid lands, *Surface waters, *Groundwater, Hydrologic cycle, Water harvesting, Ephemeral streams, Water quality, Water table, Aquifers, Southwest U.S., Artificial recharge, Groundwater mining, Saline water intrusion, Confined water.
Identifiers: *Qanats, Australia, North Africa, USSR, Fossil water.

This chapter is a broad review of the state of knowledge of management and use of arid lands water supplies through 1965. The way arid land waters are managed has profound effect on quantity, quality and timing of water available for beneficial use by man. Social and economic as well as purely physical aspects must be considered for optimum development in arid lands. Particular emphasis is placed on groundwater since it is normally a more reliable source than fluctuating or ephemeral surface waters in arid zones. The qanats of the Middle East and Asia, artesian wells and natural and artificial recharge of aquifers underlying dry but arable lands are discussed. The hazards of mismanagement of groundwater are emphasized. All of these forms of mismanagement can cause a decline in both quantity and quality of water available, increasing costs and subsequent decline in economic value of the groundwater body. (Crouse-Arizona)
W70-00706

NORTH CAROLINA AND OTHER ATLANTIC STATES,
For primary bibliographic entry see Field 06E.
W70-00770

CURRENT DEVELOPMENTS IN GROUND WATER LAW.

Am Water Works Assn J, Vol 41, No 11, p 1002-1012, Nov 1949. 11 p.

Descriptors: *Groundwater, *Legislation, *Water allocation (Policy), Well permits, Well regulations, Subsurface waters, Water permits, Non-consumptive use, Water utilization, Preferences (Water rights), Appropriation, Prior appropriation, Priorities, Air conditioning, Water resources, Administrative agencies, Water supply.

The legislative developments in limiting the use of ground water are discussed. In Indiana, legislation limiting the use of ground water for cooling air will soon be supplemented by proposed legislation which will allow limiting the use of ground water where its withdrawal exceeds or threatens to exceed the natural replenishment of such waters. In Kansas, legislation requires persons intending to acquire an appropriation right to waters to apply to the state for a permit in order to establish priority. New Jersey generally allocates waters on application after proof of public necessity, non-interference with existing water supplies, protection of the supply from contamination, and protection of the dry weather flow of the stream. Recent legislation also allows the regulation of private wells. In New York, the Water Power and Control Commission must approve all applications involving the development of new water supplies. A serious deterioration of ground water conditions in four Long Island counties brought forth recent legislation which requires licensing of all well drillers within those counties. Ohio has legislation regulating defective wells. Legislation also requires well drillers to submit logs of all water wells drilled. (Gabrielson-Florida)
W70-00774

4C. Effects on Water of Man's Non-Water Activities

DEPARTMENT OF CONSERVATION.
Minn Stat secs 84.156 thru 84.162, 84.415, 84.43 thru 84.45 (1964), as amended (Supp 1968).

Descriptors: *Minnesota, *Easements, *Right-of-way, *Conservation, Water conservation, Dams, Condemnation, Overflow, Utilities, Permits, Federal government, Overland flow, Water control, Highways, Legislation, Damsites, Public health, Natural resources, Boating regulations, Boats, Public lands, Resource development, Administrative agencies, United States.
Identifiers: *Flowage easements, Public waters.

The United States is granted an easement and right to flow and overflow the right-of-way of any highway lying within the Lac qui Parle Water Control Project below the 945.0 foot elevation. The state Commissioner of Conservation is authorized to acquire the underlying fee title or right to flow to the right-of-way of any highway lying within such water control project and to transfer same to the United States. The Commissioner is also authorized to acquire all dam site and flowage easements necessary to accomplish the purposes of this section and to construct all control works needed to restore and control the water level. The right to condemn land and to enter into contracts with the United States is also given. The Commissioner may grant licenses to utility companies permitting passage over, under, or across state-owned lands or water. Such permits are subject to revocation if in conflict with a public use of the land or water. The regulation of watercraft is declared necessary for the protection of public health and for the conservation of natural wilderness conditions and other natural resources. The Commissioner is empowered to designate wilderness areas. (Schram-Florida)
W70-00583

A CLIMATOLOGICAL EVALUATION OF PRECIPITATION PATTERNS,
Public Health Service, Washington, D.C
J. P. Changnon, Jr.
SEC Technical Report A62-5, Symposium, Air Over Cities, Nov 1969, Cincinnati, Ohio, p 37-67. 6 fig, 11 tab, 17 ref.

Descriptors: *Urbanization, *Urban effects, *Rainfall distribution, *Raingages, *Distribution patterns, Temperature, Air pollution.
Identifiers: Champaign-Urbana urban area, Seasonal precipitation pattern, Synoptic conditions.

A 13-year measurement program of urban rainfall distribution in Champaign-Urbana, a moderate sized municipality of Illinois is described in this article. The monthly, seasonal, and annual precipitation patterns derived from the network data are discussed. The annual precipitation pattern is compared with that of a nearby rural network to help evaluate the apparent urban-affected precipitation pattern obtained over the urban area. The urban effects have been claimed to produce increases in precipitation on the order of 5 to 15%. The results of Champaign-Urbana study have shown that the precipitation maximization in Urbana could easily be claimed to result either from urban effects or from natural variations of precipitation. Raingage exposures presented a problem in the evaluation of effects. To instrument an urban area for this purpose is difficult and tremendously expensive. Natural variations of precipitation pose another problem. (Upadhyaya-Vanderbilt)
W70-00740

4D. Watershed Protection

CIVIL LAW PROPERTY--ALLUVION DISTINGUISHING LAKES FROM RIVERS AND STREAMS,
Kenneth E. Gordon, Jr.
La L Rev, Vol 25, No 2, p 554-558, Feb 1965. 5 p, 19 ref.

Descriptors: *Louisiana, *Alluvion, *Riparian rights, *Classification, Water law, Remedies, Rivers, Streams, Lakes, Evaluation, Navigable rivers, Navigation, Accretion (Legal aspects), Bank erosion, Silts, Erosion, Channel morphology, Sediments, Boundaries (Property), Judicial decisions, Geologic investigations, Legal aspects.

The classification of a body of water as a stream, river, or lake has important consequences in Louisiana property law. The governing article of the Louisiana Civil Code does not refer to lakes in its application of the rules of accretion formed to any soil on the shore of a river or other stream. The crucial question becomes whether a particular body of water is to be classified as a lake, a river, or a stream and what test should be employed to make the classification. Jurisprudence prior to State v Cockrell, 162 So 2d 361 (La. App 1st Cir. 1964), indicates that a body of water is a river or stream if the water moves, albeit not constantly and has the power to carry silt and form alluvion. In Cockrell, the court went beyond the evidence of current sufficient to carry alluvion and considered other geological characteristics presented by experts as being typical of streams as opposed to lakes. This decision makes possible the use of expert testimony and physical evidence all of which could greatly simplify the difficulties of classifying bodies of water. (Moulder-Florida)
W70-00541

THE CHICAGO WATER DIVERSION CONTROVERSY,
Herbert H. Naujoks.
Marq L Rev, Vol 30, No 3, p 149-176, Dec 1946. 28 p, 45 ref.

Descriptors: *Illinois, *Diversion, *Water resources development, *Legal aspects, State governments, Damages, Remedies, Water pollution, Great Lakes, Water level fluctuations, Diversion losses, Diversion structures, Legislation, Mississippi River, Pollution abatement, Discharge (Water), Drainage effects, Drainage systems, Judicial decisions, Canals, Flow augmentation, Flow control.
Identifiers: *Chicago, Constitutions.

This is the first of two articles dealing with the Chicago Water Diversion Controversy. Part One deals with the history and present status of the controversy. It offers an account of the history and background of this litigation and describes the status of the problem up until 1946. It touches on the legal issues involved, as well as the physical features of the Great Lakes-St. Lawrence system, the Illinois Waterway, the Chicago Drainage Canal, the details concerning sewage disposal in the Chicago area, and related matters. (Heckerling-Florida)
W70-00554

REAL PROPERTY--ALLUVION AND ACCRETION--ARTICLE 509 OF THE LOUISIANA CIVIL CODE,
For primary bibliographic entry see Field 06E.
W70-00560

GREAT LAKES BASIN COMPACT.
For primary bibliographic entry see Field 06E.
W70-00592

ESTABLISHMENT AND SURVIVAL OF SEVERAL GRASSES IN THE SAGEBRUSH TYPE, WEST-CENTRAL NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
O. D. Knipe.
US Forest Serv Res Note RM-149, 1969. 2 p.

Descriptors: *Vegetation establishment, *Erosion control, Range management, Revegetation, Vegetation regrowth, Watershed management, Rehabilitation, New Mexico.

Several grasses were drill-seeded in the sagebrush (Artemesia tridentata) type of west-central New Mexico to test their establishment, survival, and erosion control potential. Competition from the existing heavy stand of sagebrush was eliminated by plowing. The species seeded were blue grama (Bouteloua gracilis), pubescent wheatgrass (Agropyron trichophorum), crested wheatgrass (A. desertorum), western wheatgrass (A. smithii), alkali sacaton (Sporobolus airoides), Indian ricegrass (Oryzopsis hymenoides), Russian wildrye (Elymus junceus), and buffalograss (Buchloe dactyloides). A good stand of all wheatgrasses, Russian wildrye, buffalograss, and Indian ricegrass, was obtained, however, at the end of the fourth growing season, the only species present in sufficient numbers were Russian wildrye and buffalograss. Losses of wheatgrass and Indian ricegrass plants was due to below average rainfall during the second growing season after seeding. It was concluded that Russian wildrye and buffalograss are well suited for use in revegetating deteriorated sagebrush sites in west-central New Mexico.
W70-00762

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

DETERMINING ORGANIC CONTAMINANTS IN AIR AND WATER,
Bureau of Mines, Pittsburgh, Pa. Pittsburgh Mining Research Center.
A. G. Sharkey, Jr., J. L. Shultz, T. Kessler, and R. A. Friedel.
Research/Development, Vol 20, No 9, p 30-32, Sept 1969. 3 p, 1 fig, 1 photo, 3 tab, 14 ref.

Descriptors: *Chemical analysis, *Pollutant identification, *Analytical techniques, *Spectrometers, *Mass, Gas Chromatography, Instrumentation, Calibrations, Organic compounds.
Identifiers: *High resolution mass spectrometry.

High resolution mass spectrometry may be used to identify organic pollutants in air and water. A major advantage of the technique is that the elemental compositions of many organic compounds may be determined on essentially total samples. A limitation is that isomers cannot be determined, but this may be overcome by combining mass spectrometry with gas chromatography and other techniques. The high resolution mass spectrographic data of several organic components of combustion and sewage wastes are tabulated and compared with results of analyses of samples of air and water from Pittsburgh. (Knapp-USGS)
W70-00427

RADIOMETRIC AND SPECTROPHOTOMETRIC DETERMINATION OF TRACE AMOUNTS OF SELENIUM USING 3, 3' - DIAMINOBENZIDINE AS THE INITIAL REAGENT,
Missouri Univ., Kansas City. Dept. of Chemistry.
James H. Wiersma, and Peter F. Lott.
Anal Letters, No 1 (10), p 655-667, 1968. 13 p, 1 fig, 2 tab, 15 ref. NIH Grant USPH GM 12830-02. OWRR Proj No A-009-MO.

Descriptors: *Chemical analysis, *Analytical techniques, *Trace elements, Spectrophotometry, Radioactivity techniques, Solubility, Laboratory tests, Chemistry, Color reactions, Indicators, Test procedures.
Identifiers: *Selenium analysis, Diaminobenzidine.

Radiometric and spectrophotometric procedures for selenium analysis were developed based on the formation and separation of the mono- and di-piazselenols of 3,3' -diaminobenzidine. Analysis of samples, reaction conditions, and sensitivity of the procedures are discussed. (Knapp-USGS)
W70-00460

DETERMINATION OF PHENOXY ACID HERBICIDES IN WATER BY ELECTRON-CAPTURE AND MICROCOULOMETRIC GAS CHROMATOGRAPHY,
Geological Survey, Washington, D.C.
Donald F. Goerlitz, and William L. Lamar.
Geol Surv Water-Supply Pap 1817-C, 1967. 21 p, 2 fig, 3 tab, 18 ref.

Descriptors: *Analytical techniques, *Herbicides, *Gas chromatography, Chemical analysis, Water analysis, Water chemistry.
Identifiers: Phenoxy acid herbicides, (2,4,5-T), (2,4-D), Silvex.

A sensitive gas chromatographic method using microcoulometric titration and electron-capture detection for the analysis of 2,4-D, silvex, 2,4,5-T, and other phenoxy acid herbicides in water is described. The herbicides are extracted from unfiltered water samples (800-1,000 ml) by use of ethyl ether, then the herbicides are concentrated and esterified. To allow the analyst a choice, two esterification procedures - using either boron trifluoride-methanol or diazomethane - are evaluated. Microcoulometric gas chromatography is specific for the detection of halogenated compounds such as the phenoxy acid herbicides whereas it does not respond to nonhalogenated components. The practical lower limits for measurement of the phenoxy acid herbicides in water primarily depend upon the sample size, interferences present, and instrumentation used. With 1-liter samples of water, the practical lower limits of measurement are 10 ppt for 2,4-D and 2 ppt for silvex and 2,4,5-T when electron-capture detection is used, and approximately 20 ppt for each herbicide when analyzed by microcoulometric-titration gas chromatography. Recoveries of the herbicides immediately after addition to unfiltered water samples averaged 92%-98%. 2,4-D may be rapidly degraded, especially if the samples are obtained from areas which have been repeatedly sprayed. (Knapp-USGS)
W70-00473

THE USE OF ARTIFICIAL SUBSTRATES IN POLLUTION SURVEYS,
Federal Water Pollution Control Administration, Duluth, Minn. National Water Quality Lab.
For primary bibliographic entry see Field 05B.
W70-00666

A NOTE ON THE DEPENDENCE BETWEEN THE CONCENTRATION OF CHLORIDE IONS AND THE RADIOACTIVITY OF EMANATION DISSOLVED IN MINERAL WATERS (IN POLISH),
Warsaw Univ. (Poland). Faculty of Geophysics.
Maria Rymaszewska.
Published in Polish with English summary. Acta Geophys Polonica, Warsaw, Vol 17, No 2, p 197-202, 1969. 6 p, 5 fig, 2 tab, 4 ref.

Descriptors: *Chemical analysis, *Radiochemical analysis, *Mineral water, *Ions, *Chlorides, Radioactivity, Water chemistry, Sodium, Potassium, Magnesium, Sulfates, Carbonates, Trace elements, Stations.
Identifiers: *Poland, Radioactive mineral waters.

Numerous samples of the radioactive mineral waters of Poland were analyzed for their contents of radon and other elements. Large concentrations of radon in the mineral waters of Poland are associated with very small concentrations of chloride ions. (Gabriel-USGS)
W70-00668

ENVIRONMENTAL SURVEILLANCE AROUND A NUCLEAR FUEL REPROCESSING INSTALLATION, 1965-1967,
New York State Dept. of Health, Albany. Bureau of Radiological Health.
For primary bibliographic entry see Field 05C.
W70-00677

MONITORING INDUSTRIAL POLLUTANTS BY THE PYROLYSIS-METHANE DETECTION METHOD,
Rocketdyne, Canoga Park, Calif. Research Div.
For primary bibliographic entry see Field 05B.
W70-00682

OIL POLLUTION OF THE SEA: DETECTION.

Harv Int L J, Vol 10, No 2, p 353-355, Spring 1969. 3 p, 4 ref.

Descriptors: *Water pollution sources, *Chemical analysis, *Oil, *Oceans, Organic compounds, Ships, Sampling, Water analysis, Measurement, Reliability, Testing.
Identifiers: *Detection, Identification, Enforcement.

Of extreme importance to the effective control of oil pollution of the sea is the problem of enforcement. The crucial issue is the matter of detecting the source of pollution. Visual surveillance is inadequate in view of the area to be policed and the rapidity with which an oil slick breaks up. To facilitate identification, some kind of system for the labeling of tanker cargo seems necessary. A tagging system has been proposed which would be reliable, nearly tamper proof, and feasible with today's technology. The system would require certain combinations of hydrocarbon compounds to be mixed with each oil cargo. Only a small, inexpensive amount would be required. Samples from discovered oil slicks would be sent to a central laboratory for analysis of the tagging compounds. With this system, the source of any oil discharge can be precisely identified. (See W70-00786). (Heckerling-Florida)
W70-00795

5B. Sources of Pollution

ESTUARINE STUDIES IN UPPER GRAYS HARBOR, WASHINGTON,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02L.
W70-00419

NITROGEN CONTAMINATION OF GROUNDWATER BY BARNYARD LEACHATES,
Guelph Univ. (Ontario). Dept. of Soil Science.
R. W. Gillham, and L. R. Webber.
J Water Pollut Contr Federation, Vol 41, No 10, p 1752-1762, Oct 1969. 11 p, 10 fig, 2 tab, 13 ref.

Descriptors: *Farm wastes, *Cattle, *Leaching, *Water pollution sources, Path of pollutants, Water pollution effects, Nutrients, Groundwater movement, Nitrogen, Waste water (Pollution).
Identifiers: Cattle wastes, Feedlot wastes.

A zone of nitrogen-contaminated groundwater associated with a barnyard was studied to determine the quantity of inorganic nitrogen reaching the groundwater from the barnyard. From piezometric potential and hydraulic conductivity measurements, quantitative flow nets were drawn permitting groundwater discharge calculations. An in-

crease from 2 to 15 mg/l inorganic nitrogen occurred in the groundwater as it passed beneath the barnyard. This resulted in a contribution of 4.4 lb (2.0 kg) of inorganic nitrogen made by the barnyard to the groundwater during the 5-month study period. The concentration of nitrogen was related to the direction of groundwater flow and was dependent on the presence of conditions suitable for the leaching of nitrogen and the dilution potential of the local groundwater flow system. The surface topography proved to be a poor indication of the direction of groundwater flow. (Knapp-USGS)
W70-00665

THE USE OF ARTIFICIAL SUBSTRATES IN POLLUTION SURVEYS,
Federal Water Pollution Control Administration, Duluth, Minn. National Water Quality Lab.
John W. Arthur, and William B. Horning, II.
The Amer Midland Natur, Vol 82, No 1, p 83-89, July 1969. 7 p, 2 fig, 3 tab, 6 ref.

Descriptors: *Bioindicators, *Water pollution effects, *Periphyton, Pollutants, Productivity, Aquatic productivity, Biomass, Ecology, Mapping, Mississippi River, Benthos, Water quality control, Sampling, Chemical analysis, Chlorophyll, Organic matter, Rivers, Biota, Habitats.
Identifiers: Minnesota River, Water pollution surveys.

Artificial substrates were constructed from pressed Masonite board and suspended in the Minnesota and Mississippi Rivers during the summer of 1965. The benthos recovered from the Mississippi River substrates reaffirmed the zones of water quality defined by results from conventional bottom sampling techniques, and analysis of chlorophyll-a indicated a progressive increase in periphyton crop below the major contributors of organic pollution. The numbers and kinds of benthic animals gathered from the Minnesota River substrates differed from results obtained from conventional bottom sampling methods, and suggest that the factor limiting river biota is a lack of suitable natural habitats rather than chemical quality. (Gabriel-USGS)
W70-00666

ENVIRONMENTAL SURVEILLANCE AROUND A NUCLEAR FUEL REPROCESSING INSTALLATION, 1965-1967,
New York State Dept. of Health, Albany. Bureau of Radiological Health.
For primary bibliographic entry see Field 05C.
W70-00677

A 5-YEAR SUMMARY OF THE REGULATORY CONTROL OF RADIOACTIVE MATERIAL IN ARKANSAS,
Arkansas State Dept. of Health, Little Rock. Div. of Radiological Health.
For primary bibliographic entry see Field 05G.
W70-00678

BIOCHEMICAL OXYGEN DEMAND AND DEGRADATION OF LIGNIN IN NATURAL WATERS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Technical Services.
E. W. Raabe.
J Water Pollut Contr Federation, Vol 40, No 5, Part 2, p 145-150, May 1968. 6 p, 3 fig, 15 ref.

Descriptors: *Biochemical oxygen demand, *Oxygen, *Lignins, *Natural streams, Rivers, Carbohydrates, Wastes, Oxidation, Analytical techniques, Pulp wastes.
Identifiers: *Lignin degradation, Kraft mill wastes.

A study of the BOD and decomposition of lignin in natural waters showed that the BOD of a stream polluted with Kraft mill wastes is related to the concentration of carbohydrates, fraction of lignin compounds oxidizable in 100 days, and possibly to other slowly oxidizable organics. The fast component (k= 0.455) of the first stage of BOD represents oxidation of wood sugars and other readily decomposable meterials. The slow component of the first stage and the second stage (k= 0.072 and 0.080, respectively) represent decomposition of lignin and its by-products and other decomposable organics. Less than 50% of the lignin compounds were oxidizable under test conditions over a period of 100 days. (Carstea-USGS)
W70-00681

MONITORING INDUSTRIAL POLLUTANTS BY THE PYROLYSIS-METHANE DETECTION METHOD,
Rocketdyne, Canoga Park, Calif. Research Div.
I. Lysji, Kurt H. Nelson, and P. R. Newton.
J Water Pollut Contr Federation, Vol 40, No 5, Part 2, p 181-187, May 1968. 7 p, 3 fig, 4 tab, 11 ref. Office of Saline Water, Contract No 14-01-0001-332.

Descriptors: *Monitoring, *Industrial wastes, *Pollutants, *Methane, Analytical techniques, Instrumentation, Gas chromatography, Detergents, Organic compounds, Water pollution control, Water quality.
Identifiers: *Pyrolysis-methane method, Hydrocarbons, Alkyl-type carbons.

Industrial pollutants containing methylene and methyl groups in their molecular structures can be monitored by pyrolytic conversion to methane without prior separation from the water. The method is based on the fact that many industrial pollutants have far higher contents of methyl and methylene groups than do natural organics. Pyrolysis is carried out at 600 deg C. A porous glass column separates the methane from the other pyrolytic products and the water vapor for subsequent measurement with a hydrogen flame ionization detector. Rapidity of analysis and high sensitivity are the major advantages of the method. (Carstea-USGS)
W70-00682

EFFECT OF PHOTOSYNTHESIS ON OXYGEN SATURATION,
Technical School, Nis (Yugoslavia).
For primary bibliographic entry see Field 05C.
W70-00683

TRITIUM IN THE ENVIRONMENT FROM NUCLEAR POWERPLANTS,
Bureau of Radiological Health, Rockville, Md.
Charles L. Weaver, Ernest D. Harward, and Harold T. Peterson, Jr.
US Dep of Health, Education, and Welfare, Public Health Reports, Vol 84, No 4, p 363-371, 1969. 1 fig, 5 tab, 12 ref.

Descriptors: *Tritium, *Environment, *Nuclear powerplants, Fallout, Public health, Radioactivity, Oxygen, Nitrogen, Nuclear explosions, Precipitation (Atmospheric), Boron, Deuterium, Electricity, Heavy water, Activation energy, Ammonia, Coolants, Irradiation, Condensation, Liquid wastes, Monitoring, Sampling, Water pollution sources.
Identifiers: Contaminant, Radioactive half-life, Beta particle, Neutrino, Cosmic radiation, Fissioning uranium, Lithium, Control rods, Neutron capture, Cladding material, Zirconium, Plutonium, Reactors, Production rates, Bureau of Radiological Health, Air ejector, Gaseous tritium, Tritiated water, Liquid scintillation counting, Southwestern Radiological Health Laboratory.

Because of its continued production and long half-life, tritium, one of the least hazardous radioactive nuclides, may increase in the environment; as tritiated water, it can be incorporated into body fluids and tissues. This paper is intended to be an information guide for public health agencies. Measurable levels of environmental tritium already prevail from the greatest single source--testing of nuclear weapons. Future tritium releases from reactors and spent fuel processing plants may increase that quantity. The mechanisms whereby tritium may be produced are influenced by reactor type, operating history, design characteristics, and construction materials. Most tritium is released as tritiated water in liquid radioactive waste, usually much less than 1% of the discharge limit specified by the Code of Federal Regulations. Since tritium is not detectable by conventional methods of gross radioactivity analysis, special analytical techniques are required. Analytical results from ten locations indicated, with one exception, that waters downstream from nuclear facilities were not significantly higher in tritium concentrations than stream waters without operating nuclear reactors. Estimates of tritium from nuclear power facilities projected for year 2000, constitute about 5% of maximum tritium activity prevailing in 1963. Tritium releases from operating power reactors are not presently dangerous to health. (Jones-Wisconsin)
W70-00716

BACTERIOLOGICAL EFFECT OF SMALL BOAT WASTES ON SMALL HARBORS,
Washington Univ., Seattle.
For primary bibliographic entry see Field 05C.
W70-00722

CONTRIBUTION OF PHOTOSYNTHETIC REAERATION TO TOTAL REAERATION OF THE PASSAIC RIVER,
Thomas J. Tuffey, and Joseph V. Hunter.
Available from ASME, 345 East 47th St, New York, NY, 10017, for $1.50 per copy, $0.75 to ASME members. Paper presented at American Society of Mechanical Engineers, American Institute Chemical Engineers Stream Pollution and Abatement Conference, June 1969. American Society Mechanical Engineers Publication 69-PID-11. 12 p, 5 fig, 5 tab, 39 ref.

Descriptors: *Photosynthesis, Oxygen demand, Dissolved oxygen, Oxygen sag, Biochemical oxygen demand, Aeration.
Identifiers: Natural aeration, Atmospheric reaeration.

Oxygen balance studies have for many years been one of the major areas of stream sanitation research. In order to better understand oxygen relationships and to accomplish the task of maintaining sufficient oxygen levels in streams, mathematical models and abstractions are essential. Through such investigations, allowable pollutional loads may be evaluated and this information utilized by sewage treatment facilities in populated areas. On the Passaic River, studies were made to evaluate the photosynthetic reaeration in terms of flow conditions, depth, and percent of total reaeration. (Whipple-Rutgers)
W70-00731

AN EXPERIMENTAL RESEARCH OF COEFFICIENT OF LONGITUDINAL DISPERSION FOR SMALL RIVERS (IN RUSSIAN),
Tallinn Polytechnic Inst. (USSR).
H. Velner, L. Paal, and L. Rohusaar.
Sbornik statei po sanitarnoi technike V, Trudy Talinskogo Politekchnicheskogo instituta, Tallin, ESSR, Seria A, p 462-485, Ho 248, 1967.

Descriptors: *Dispersion, *Flow characteristics, Water pollution, Water pollution effects, Mixing, Diffusion, Conducting, Streams, Turbulence.
Identifiers: Longitudinal mixing coefficient.

This work deals with the results of an experimental research of the longitudinal dispersion coefficient for small streams. The coefficient has been determined by experimental means using common salt (NaCl) and measuring electrical conductivity of water. The coefficient of longitudinal dispersion has been calculated: (1) according to the data of maximum concentration of the cloud of pollutant, and (2) according to the change of variance of the cloud of pollutant along the river. The following

has been established: (1) determining the coefficient of longitudinal dispersion by the method of maximum concentrations, as proposed, given reliable results; (2) the coefficient of longitudinal dispersion for small rivers, according to experimental data of the authors, has the magnitude of 0.2 - 1.5 m sq/sec; (3) the coefficient of longitudinal dispersion D for small rivers can be determined with a sufficient accuracy (sigma= plus or minus 20%) as D= 1.5 mu B, where mu is the mean velocity of the stream and B is the width of the stream. (Novotny-Vanderbilt)
W70-00743

OIL POLLUTION OF THE SEA.
For primary bibliographic entry see Field 05G.
W70-00786

OIL POLLUTION AND THE SEA: THE SOURCES OF POLLUTION.

Harv Int L J, Vol 10, No 2, p 316-320, Spring 1969. 5 p, 30 ref.

Descriptors: *Water pollution sources, *Oil, *Ships, Transportation, Natural resources, Oil industry, Accidents, Oceans, Sea water, Cleaning, Oily water, Oil wells, Wastes, Chemical wastes.
Identifiers: *Tankers, *Oil pollution, Ballast, Seeps.

The problem of oil pollution actually began in the early part of the 20th century when naval and merchantile vessels began using fuel oil in place of coal. About the same time, the increased demand for oil for use on land required the importation of large quantities by ship. Each year the number and size of oil tankers has increased to meet this demand. While the discharge of oil by tankers is most publicized during a spectacular disaster like the recent 'Torrey Canyon' incident, the largest portion of oil pollution results from the ballasting and cleaning of ships. The large numbers of tankers and their numerous voyages combine to represent a large source of pollution. Another source is submarine oil wells which occasionally leak. A small amount of oil also comes from shipping sunk during World War II. Finally natural sources contribute some oil each year. (See W70-00786). (Heckerling-Florida)
W70-00787

OIL POLLUTION OF THE SEA: DETECTION.
For primary bibliographic entry see Field 05A.
W70-00795

5C. Effects of Pollution

ESTUARINE STUDIES IN UPPER GRAYS HARBOR, WASHINGTON,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02L.
W70-00419

THE USE OF INVERTEBRATES IN A WATER QUALITY INVESTIGATION: A BIOLOGICAL STUDY OF THE MIAMI RIVER, OHIO,
Stanford Univ., Calif. Dept. of Civil Engineering
P. Jonathan Young.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 304-313, 1967. 10 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Water pollution effects, *Bioindicators, *Water quality, *Dissolved oxygen, *Ohio, Water temperature, Sludge worms, Bloodworms, Aquatic bacteria, Algae, Mayflies, Caddisflies.
Identifiers: Great Miami River (Ohio).

A biological study was made of the Great Miami River, Ohio to determine the factors causing variations in aquatic life. Sampling sites were chosen to vary as little as possible in all characteristics except water quality. The variety of life was most related to dissolved oxygen, and water temperature was the next most important factor. The water pollution conditions were divided into 4 zones. Very polluted: Here, bacteria and protozoans are abundant. Only a few species of animals exist (sludge worms, blood worms, and maggots) and these live on decaying matter or bacteria. Green plants are usually absent. Sewage fungus may occur. Polluted: Bacteria are still abundant and oxygen is low. Green algae begin to appear and bloom, and some of the more tolerant invertebrates and rooted plants are found. Semi-healthy: Algae blooms have usually disappeared. Most of the polluted-favoring organisms are decreasing in abundance while less tolerant species begin to appear. Dissolved oxygen may average 5 ppm or more. Healthy: The animal and plant life is more or less normal. Decomposition continues at a much reduced rate. Dissolved oxygen is high and approaches saturation values. Three insects were chosen to separate the classification zones. The larva of the damselfly Ishnura was chosen to separate 'poluted' from 'very polluted.' The larva of the mayfly Baetis was chosen to separate 'semi-healthy' from 'polluted'; and the caddis fly larva Hydropsyche was chosen to signify the beginning of the 'healthy' zone. Along the Great Miami River, the progression of these invertegrates was found to be very consistent. (Knapp-USGS)
W70-00475

WATER QUALITY OBJECTIVES,
For primary bibliographic entry see Field 06B.
W70-00506

SEWAGE FUNGUS: ITS NATURE AND EFFECTS,
Water Pollution Research Lab., Stevenage (England).
E. J. C. Curtis.
Water Research, Vol 3, No 5, p 289-311, May 1969. 23 p, 9 fig, 1 tab, 132 ref.

Descriptors: *Fungi, *Sewage effluents, *Water pollution, Bioindicators, Bacteria, Protozoa, Water quality control, Dissolved oxygen, Hydrogen ion concentration, Streams, Organic compounds.
Identifiers: *Sewage fungus, Physiological ecology.

An extensive literature dealing with sewage fungus is reviewed. This fungus is a sensitive indicator of organic pollution in water. Sewage fungus comprises a community of bacteria, fungi, and protozoa which are normal inhabitants of rivers and form macroscopic slimes only in polluted water. Illustrations are included for 10 common sewage fungus organisms. The ecology, physiology, and nutrition of the most common organisms are described. The most widespread organisms in sewage fungus are the filamontous bacteria; Sphaerotilus natans received special attention. Taxonomy, morphology, and mineral requirements are discussed and the effects of flow, effects of temperature, effects of pH value, and effects of dissolved oxygen concentration are described. Sewage fungus is likely to develop in places with organic pollution, especially in effluents containing organic nutrients of low molecular weight. The only efficient know method to prevent the growth of sewage fungus is the removal of the nutrients before the effluents are discharged. (Carstea-USGS)
W70-00637

CHEMICAL INTERACTIONS OF WASTEWATER IN A SOIL ENVIRONMENT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05D.
W70-00658

BACTERIA, CARBON DIOXIDE, AND ALGAL BLOOMS,
Wyandotte Chemical Corp., Mich.
L. E. Kuentzel.
J Water Pollut Contr Federation, Vol 41, No 10, p 1737-1747, Oct 1969. 11 p, 51 ref.

Descriptors: *Eutrophication, *Algae, *Nutrients, *Carbon dioxide, *Reviews, Bibliographies, Bacteria, Decomposing organic matter, Waste water (Pollution).
Identifiers: Algal blooms.

A recent literature survey on the subject of lake eutrophication, and algal blooms and nutrients as causative factors, reveals that there is a decided lack of published information on the role of the major nutrient, carbon dioxide. Great emphasis is placed on phosphorus and nitrogen as causative agents in the production of unwanted algal growths, yet a satisfactory accounting for the source of the tremendous amounts of carbon dioxide required for massive algal blooms has not been found in the literature. The purposes of this paper are (a) to provide some logistics on carbon dioxide requirements for such blooms, (b) to establish the fact that such quantities of carbon dioxide are not available from the atmosphere and dissolved salts, and (c) to point out the role played by bacteria and decomposable organic matter. (Knapp-USGS)
W70-00664

NITROGEN CONTAMINATION OF GROUNDWATER BY BARNYARD LEACHATES,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 05B.
W70-00665

ECOLOGICAL FACTORS AND THE DISTRIBUTION OF CLADOPHORA GLOMERATA IN THE GREAT LAKES,
Wisconsin Univ., Milwaukee. Dept. of Botany.
Richard P. Herbst.
The Amer Midland Natur, Vol 82, No 1, p 90-98, July 1969. 9 p, 3 fig, 1 tab, 15 ref.

Descriptors: *Ecology, *Eutrophication, *Great Lakes, *Algae, Nutrients, Phosphorus, Population, Pollutants, Mapping, Hydrogen sulfide, Cities, Lake Huron, Lake Erie, Lake Ontario, Lake Michigan, Water temperature, Phosphates, Turbidity.
Identifiers: Cladophora glomerata.

Nutrient enrichment in the Great Lakes has provided fertile areas for growth of algal nuisances. One of these species, Cladophora glomerata, has become a major problem for many cities bordering the Great Lakes. Ecological factors concerning its growth in Milwaukee's Harbor were studied, and its distribution in the Great Lakes determined. Phosphorus levels appear to be closely linked with Cladophora increases. (Gabriel-USGS)
W70-00667

ENVIRONMENTAL SURVEILLANCE AROUND A NUCLEAR FUEL REPROCESSING INSTALLATION, 1965-1967,
New York State Dept. of Health, Albany. Bureau of Radiological Health.
William J. Kelleher.
Radiol Health Data and Rep, Vol 10, No 8, p 329-339, Aug 1969. 11 p, 4 fig, 11 tab, 9 ref.

Descriptors: *Environmental effects, *Radioactive wastes, *Nuclear power plants, *Monitoring, Streams, Milk, Watersheds (Basins), Silts, Fish, Deer, Iodine radioisotopes, Public health, Radioactivity, Strontium radioisotopes, Cesium.
Identifiers: *Environmental surveillance, Liquid wastes, Health hazards, Nuclear fuel reprocessing plants.

A summary report of environmental surveillance around the Ashford, N.Y. nuclear fuel reprocessing plant is presented. This report includes data obtained before and after the plant began operations in April 1966. Media monitored included air and milk supplies in the surrounding area; liquid wastes; local watersheds and streams; silt, deer, and fish in the plant perimeter area. Data obtained through 1967 indicate that the discharges from the plant stack have not produced environmental effects from particulate beta-particle emitters or iodine-

131 that might constitute a public health hazard. Surveillance of the streams showed greater concentrations of strontium-90 during the fall and winter of 1966-1967 than in the latter part of 1967. Silt removed more cesium-137 than strontium-90; most of the latter was in the dissolved state. The ratio of cesium-137 to cesium-134 (cesium-134 is indicative of spent fuel) in the wastes was about 4 or 5 to 1. The levels of radioactivity in deer and fish were sufficiently high to require careful evaluation of the public health significance. (Carstea-USGS)
W70-00677

EFFECT OF PHOTOSYNTHESIS ON OXYGEN SATURATION,
Technical School, Nis (Yugoslavia).
Lazar R. Ignjatovic.
J Water Pollut Contr Federation, Vol 40, No 5, Part 2, p 151-161, May 1968. 11 p, 3 fig, 2 tab, 9 ref.

Descriptors: *Photosynthesis, *Oxygen, *Saturation, Temperature, Pressure, Mixing, Evaporation, Supersaturation, Reservoirs, Algae, Bodies of water, Dissolved oxygen, North Carolina.
Identifiers: *Oxygen supersaturation, Vertical mixing, Roanoke Rapids Reservoir (NC).

Temperature changes, pressure changes, vertical mixing of stratified water, and evaporation are discussed and evaluated in order to clarify the phenomenon of oxygen supersaturation in natural bodies of water. Data from Roanoke Rapids Reservoir in North Carolina were used. Supersaturation with dissolved oxygen may be an high as 25% at a 5 ft depth and at an average temperature of 25 deg C. These changes cannot account for observed supersaturation. Some significance to the supersaturation is attached to the effects of sunshine and algal growth. Photosynthesis is the only force capable of producing the supersaturation of such a magnitude. (Carstea-USGS)
W70-00683

GROWTH AND RESISTANCE TO STRESS IN BROOK TROUT FED SUBLETHAL LEVELS OF DDT,
New Hampshire Univ., Durham. Dept. of Zoology.
Kenneth J. Macek.
J Fish Res Board of Canada, Vol 25, No 11, p 2443-2451, 1968. 9 p, 1 fig, 2 tab, 16 ref.OWRR Proj B-001-NH.

Descriptors: *Pesticide toxicity, *Brook trout, *DDT, Fishkill, Morbidity, Mortality, Water pollution effects, Water temperature, Water quality, Nutrients, Fish diets, Nutrient requirements.
Identifiers: DDT tolerance (Trout).

When underyearling brook trout were fed DDT at a rate of 2.0 mg/kg per week for 31 weeks, they exhibited greater weight gain (43.2 g) during the period than did untreated fish (36.6 g). When underyearling fish were fed DDT at different rates for 26 weeks and then starved or fed at a rate equivalent to 10% of the usual feeding rate, the cumulative mortality during this period was 96.2% among fish exposed to 3.0 mg/kg per week, 88.6% among fish exposed to 2.0 mg/kg per week, and 1.2% among untreated fish. Differences in the length of survival of DDT-exposed fish occurred due to dosage, sex, and type of starvation. The evidence suggests that the mortality of DDT-exposed fish was due to the interaction of DDT residues with a combination of environmental stresses, including starvation, decreasing water temperature, and possibly the physiological stress associated with the spawning season. (Knapp-USGS)
W70-00684

THE UPTAKE, ACCUMULATION AND EXCHANGE OF STRONTIUM-90 BY OPEN SEA PHYTOPLANKTON,
Miami Univ., Fla. Inst. of Marine Science.
E. F. Corcoran, and J. F. Kimball, Jr.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Ft Collins, Sept 10-15, 1961. Radioecology, Reinhold Pub Corp, N Y and Amer Institute of Biological Sciences, Washington, D C, Schultz, Vincent and Klement Alfred W Jr (Eds), p 187-191, 1963. 5 fig, 4 tab, 7 ref.

Descriptors: *Strontium radioisotopes, *Phytoplankton, Radioactivity, Waste disposal, Nuclear reactors, Powerplants, Ships, Submarines, Effluents, Ion exchange, Resins, Leakage, Cesium, Nuclear explosions, Absorption, Adsorption, Atlantic Ocean, Diatoms, Neritic algae, Ions, Water pollution effects, Water pollution sources, Radioecology.
Identifiers: *Radionuclide uptake, *Radionuclide accumulation, *Radionuclide exchange, *Open sea, Weapons testing, Nuclear Ship Savannah, Zirconium-95, Rubidium-106, Niobium-95, Gymnodinium simplex, Flagellates, Eleuthera Island, Nitzchia seriata, Navicula, Florida current, Yttrium-90, Katodinium rotundata.

Authors used five cultures of oceanic phytoplankton to determine their ability to concentrate strontium (Sr) from sea water, with the objective of ascertaining whether results of studies with neritic and freshwater forms can apply to neritic organisms. The experiments were short-termed, and were conducted during active growth phases to eliminate possibility of nutrient deficiencies and over-population, to minimize bacterial interference, and to emulate natural conditions as closely as possible. All cells grown in media containing strontium-90-yttrium-90 became radioactive. Uptake of Sr was proportional to the concentration of Sr in the medium, cells being able to concentrate radioactive Sr from 18.6 to 381.7 times its ambient concentration. Cell growth, in media containing up to ten times normal concentration of Sr, was not inhibited. Media containing high concentrations of Sr had little effect on ability of cells to accumulate Sr-90. Adsorption was found to play an important role in accumulation of Sr-90. While these results are preliminary, it should be noted that primary producers in marine environments can accumulate Sr-90 from sea water. Controlled laboratory experiments have the advantage of allowing comparisons between various phytoplankters and radionuclides. (See Vol. 2, No. 19, W69-07863.) (Jones-Wisconsin)
W70-00707

THE ROLE OF PHYTOPLANKTON IN THE CYCLING OF RADIONUCLIDES IN THE MARINE ENVIRONMENT,
Bureau of Commercial Fisheries, Beaufort, N.C.
T. R. Rice.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, Reinhold Pub Corp, N Y and Amer Institute of Biological Sciences, Washington, D C, Schultz, Vincent and Klement, Alfred W Jr (Eds). p 179-185, 1963. 5 fig, 8 tab, 23 ref.

Descriptors: *Phytoplankton, *Cycling, *Radioisotopes, Sea Water, Food chains, Phosphorus radioisotopes, Cobalt radioisotopes, Uranium radioisotopes, Nuclear explosions, Strontium radioisotopes, Cesium, Physicochemical properties, Adsorption, Colloids, Zinc radioisotopes, Calcium, Potassium, Clams, Size, Algae, Diatoms, Trace elements, Metabolism, Ions, Chlorella, Water pollution effects, Water pollution sources, Niches, Radioecology.
Identifiers: *Marine environment, Cerium-144, Nitzschia closerium, Artemia, Carteria, North Temperate Zone, Plutonium, Half-life (Radionuclide), Filter-feeding animals, Ruthenium-106, Platymonas, Thalassiosira, Amphidinium klebsi, Porphyridium cruentum, Radionuclide uptake, Nannochloris, Thoracomonas, Yttrium, 'Biological dilution', Physiological condition, Mercenaria mercenaria.

The importance of phytoplankton in cycling radionuclides in oceans depends upon number and concentration of radionuclides accumulated, length of time they are retained by the phytoplankton, size of phytoplankton cells, numbers of cells present in the water, and efficiency of digestion of phytoplankters by filter-feeding animals. The availability of a radionuclide in sea water depends largely upon its physical state (colloidal or particulate) as well as its ionic state. Accumulation is dependent on amounts of the element present in sea water and the quantities of other metabolically similar elements. Binary fission of radioactive phytoplankters in nonactive water results in 50% reduction of activity per cells with each division, termed as 'biological dilution.' Different species of phytoplankton, which accumulate a radionuclide to the same level and are removed from the water with the same efficiency by a filter-feeding animal, may not result in the animal's becoming equally radioactive, for all species of phytoplankton are not digested with equal efficiency. Brine shrimp (Artemia) concentrate radiocobalt to higher levels fed upon radioactive Carteria cells, than when radioactivity is derived from the water. (See Vol. 2, No. 19, W69-07863.) (Jones-Wisconsin)
W70-00708

POLYCHLORINATED BIPHENYLS IN THE GLOBAL ECOSYSTEM,
California Univ., Berkeley. Marine Resources Inst.; California Univ., Davis. Dept. of Zoology; Cornell Univ., Ithaca, N.Y. Div. of Ecology and Systematics; and San Diego Natural History Museum, Calif.
R. W. Risebrough, P. Reiche, D. B. Peakall, S. G. Herman, and M. N. Kirven.
Nature, Vol 220, No 5172, p 1098-1102, Dec 1968. 1 fig, 4 tab, 42 ref.

Descriptors: *Ecosystems, *Water pollution effects, Insecticides, Birds, Enzymes, Reproduction, Chlorinated hydrocarbon pesticides, Canal Zone, DDT, Peregrine falcon, Mexico, Fishes, Gas chromatography, Mass spectrometry, Pacific Ocean, Dieldrin, Antarctic, California, Conservation, Toxicity, Endrin, Colorado River, Mammals, Water pollution sources.
Identifiers: *Polychlorinated biphenylas, *Pesticides, Enzyme induction, Biocides, Calcium metabolism, Reproductive metabolism, p-p'-DDE, Steroid metabolism, Dohrman microcoulometric detector, DDE, Toxaphene, Fat metabolism, Eggshell thickness, Environmental quality, Hawks, Owls, San Francisco Bay, Gulf of Panama, Farallon Island, Baja California (Mexico), Puget Sound, Panama City (Panama), San Diego Bay, Estradiol metabolism.

Authors present extensive tabular data pertaining to the following subjects: chlorinated hydrocarbons in North American peregrine falcons; DDT and polychlorinated biphenyls (PCB) in prey species of peregrine falcons in the Gulf of California; PCB and DDT in the global ecosystem (including species of birds, mammals, and fishes); and increase in oestradiol metabolism in liver homogenates from pigeons treated with various chlorinated hydrocarbons. Analysis of these data indicates that PCB, powerful inducers of hepatic enzymes which degrade oestradiol, are widely dispersed in the global ecosystem. Together with other chlorinated biocides, including DDT, they could account in large measure for aberrations in calcium metabolism observed in many birds after World War II. Authors point out that the relatively small amounts of chlorinated hydrocarbons required to effect changes in reproductive metabolism make those approaches to pollutional ecology based on toxicity data in order of magnitude of parts per million irrelevant. (Eichhorn-Wisconsin)
W70-00709

EFFECTS OF TOXICANTS ON COMMUNITY METABOLISM IN POOLS,
Bureau of Sport Fisheries and Wildlife, Warm Springs, Ga.
Walter R. Whitworth, and Thomas H. Lane.
Limnology and Oceanography, Vol 14, No 1, p 53-58, 1969. 2 fig, 2 tab, 6 ref.

escriptors: *Antimycin A, *DDT, *Diquat, Bull-eads, Sunfishes, Plankton.
lentifiers: *Community metabolism, *Community espiration, Bluegills, Diel oxygen techniques.

ates of community metabolism are estimated to est the efficacy of a diel oxygen technique in roviding indices of acute and chronic effects of oxicants. Thirty-eight experimental communities ere exposed to concentrations (in milli-rams/liter) of 0.02 p,p'-DDT (1,1,1-trichloro-2,2 is (p-chloropenyl) ethane); 0.1 antimycin A; 9.2 otassium permanganate; 0.9 and 2.6 formalin; 0.0 nigrosine black; 2.0 and 10.0 malachite green; .1 Diquat and 0.5 and 5.0 copper sulfate. Dis-olved oxygen was measured with an oxygen elec-rode; nutrients were added to bring all pools to a otal hardness of 100 milligrams/liter. Results in-icate that DDT, antimycin A and potassium per-anganate had no adverse effects on community espiration, although DDT and antimycin A were ethal to some plankton and several species of fish Centrarchidae, Cyprinidae, Ictaluridae). The emaining toxicants usually depressed community xygen production and increased community espiration for periods of 1 to 20 weeks. The ethod used is an effective and economical bioas-ay. Tabular data include sample computations and cute effects of toxicants; oxygen metabolism data re presented graphically. (Voigtlander-Wiscon-n)
V70-00710

OBSERVATIONS ON DEEPWATER PLANTS IN AKE TAHOE, CALIFORNIA AND NEVADA,
levada Fish and Game Dept., Reno; and California tate Dept. of Fish and Game, Sacramento. Inland isheries Branch.
or primary bibliographic entry see Field 02H.
V70-00711

ERTICAL DISTRIBUTION OF PHOSPHORUS N LINSLEY POND MUD,
Duke Univ., Durham N.C. Dept. of Zoology.
or primary bibliographic entry see Field 02H.
V70-00712

EASONAL SELECTION OF ESTUARINE BAC-ERIA BY WATER TEMPERATURE,
Rhode Island Univ., Kingston. Narragansett Marine ab.
ohn McN Sieburth.
ournal Experimental Marine Biology and Ecology, ol 1, p 98-121, 1967. 11 fig, 4 tab, 39 ref.

Descriptors: *Bacteria, *Estuarine environment, Water temperature, *Seasonal, Rhode Island, ampling, Ecology, Ammonia, Enzymes, Classifi-ation, Growth rates, Seawater, Incubation, Pseu-omonas, Subsurface-waters, Bottom sediments, urface waters, Detritus, Light intensity, Turbidity, lgae, Diatoms, Cycling nutrients, Physiological cology, Water pollution effects, Phytoplankton.
Identifiers: Narragansett Bay (Rhode Island), Tax-nomic types, Heteretrophy, Bacterial medium, rthrobacter, Flora, Ambient temperature, Ther-al sensitivity, Genera, 'Flavobacterium-ytophaga', Vibrios, Achromobacters, Gram-posi-ive bacteria, Sarcine-like, Bacillus-like, Micrococ-us-like, Psychrophiles, Plemorphic, Myceloid, Coryneform rods, Cocci, Arthrospores, Gram-egative bacteria, Colony development.

Heteretrophic planktonic bacteria were observed n temperature Narragansett Bay, Rhode Island, to stablish whether seasonal water temperature hanges are sufficient to select thermal and tax-nomic types. Population changes were examined n semi-monthly samples and genera determined or 2500+ isolates; growth-temperature spectra of 00 representative isolates at 20 temperatures, 2C C= degrees Celsius) apart, were examined. Growth range of natural bacterial populations aried with water temperature. All thermal types were isolated and population trends observed. Mesophilic isolates (growth above 10C; optimum ave above 30C) were only obtained on plates at 36C when water temperature exceeded 10C. Several mesophiles were cold-sensitive and labile below 18C. Obligate psychrophiles (growth below 16-20C; optimum 9-10C) were only obtained on 0C plates where water temperatures were below 10C. Two additional thermal types were obtained on both 0 and 18C plates. Organisms which grew at 0C (optimum 10-30C) were considered facultative psychrophiles; those which grew at 0C (narrower optimum, 18-20C), psychrotolerant. Besides these major thermal types, a few isolates of several taxonomic groups exhibited tendency for multiple temperature optima. Seasonal selection of thermal types of water temperature occurred in all taxonomic groupings. (Jones-Wisconsin)
W70-00713

ACCUMULATION OF DIELDRIN BY FISH AND SELECTED FISH-FOOD ORGANISMS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
George G. Chadwick, and Robert W. Brocksen.
Journal of Wildlife Management, Vol 33, No 3, p 693-700, July 1969. 8 fig, 14 ref.

Descriptors: *Dieldrin, *Laboratory tests, *Sculpins, *Tubificids, Bioassay, Midges, Pesticide residues, Water pollution effects.
Identifiers: *HEOD, Cottus preplexus, Tubifiex, Chironomidae, Insecticide retention.

Accumulation rates of a component of dieldrin--1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4-endo, exo-5, 8-dimethanonaphthalene (HEOD)--from water and food by fish (sculpin) and fish-food organisms (tubificids and midge larvae) were determined under laboratory conditions. Dieldrin was introduced into test aquaria by percolating water through a column of inert material coated with the insecticide. Accumulation and retention of dieldrin was determined by gas-liquid chromatographic analysis for HEOD. Sculpins kept at 15 deg C were exposed to five concentrations of HEOD ranging from 0.017 to 8.60 parts per billion (ppb). Fish were fed a daily maintenance ration (3% of their wet weight) of uncontaminated tubificid worms. Uptake and storage of HEOD at a given concentration is a function of time; accumulation occurred at a nearly constant rate at each concentration, with no evidence of saturation within the exposure period (32 days). Tubificid worms exposed to 80 ppb HEOD (a toxic concentration for fish) had accumulated 365 parts per million (ppm) HEOD at 32 days. Worms containing 150 ppm HEOD retained 62 ppm after 16 days in uncontaminated water. Fish retained lower proportions of available HEOD when their food consumption was greater. Authors conclude that 16% of accumulated HEOD at 21 days was maximum attributable to contaminated food. (Voightlander-Wisconsin)
W70-00714

EFFECTS OF FERTILIZERS ON WATER QUALITY.
Tennessee Valley Authority, Muscle Shoals, Ala. Soils and Fertilizer Research Branch.

National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Alabama, 1969. 107 p, 141 ref. J M Soileau (compiler).

Descriptors: *Abstracts, *Agricultural watersheds, *Fertilizers, *Water quality, Nitrogen, Phosphorus, Potassium, Tennessee Valley Authority Project, Water balance, Eutrophication, Cycling nutrients.
Identifiers: *Nutrient cycles, Nutrient losses.

Report includes a compilation of 701 abstracts plus 141 supplemental references. Abstracts are classified under the general headings of: Problem Identification and Introduction; Natural Nutrient Cycles (N (nitrogen), P (phosphorus), K (potassium)) in the Exosystem; Water Volumes; Fertilizer Use on Agricultural Lands in the United States; Nonwater Pathways of Fertilizer Nutrients (N,P,K) Added to Soils; Losses of Fertilizer Nutrients (N,P,K) Through Water Pathways; and, Other Sources of Water Pollution. Abstracts are cross-indexed where appropriate. Author, geographical, and soils indexes are provided. (Voightlander-Wisconsin)
W70-00717

PESTICIDES AND FISHES--A REVIEW OF SELECTED LITERATURE,
Arizona State Univ., Tempe. Dept. of Zoology.
Donald W. Johnson.
Transactions of the American Fisheries Society, Vol 97, No 4, p 398-424, Oct 1968. 5 tab, 156 ref.

Descriptors: *Fishes, *Pesticides, *Reviews, *Bibliographies, Chlorinated hydrocarbon pesticides, Carbamate pesticides, Organophosphorus pesticides, Inorganic pesticides, Herbicides.
Identifiers: *Literature review.

Author presents a literature review and critique of research to date on pesticide interactions in aquatic habitats. Thirty-four pesticides are considered, with special emphasis being placed on their effects on freshwater and marine fishes; author stresses importance of ascertaining the physical and biological factors that affect toxicity. Data are discussed in terms of mean lethal concentrations--concentrations lethal to 50% of the fish. Literature is reviewed under the general headings: factors affecting toxicity; pesticide residues; effects of pesticides on and in aquatic food chain; action of pesticides on fishes; and pesticide analysis. Field studies have lagged behind laboratory studies and very little work has been done on pesticide effects on invertebrate populations. The need for studies of ecological and physiological effects of sublethal quantities is stressed, in order that realistic tolerance limits of toxic pollutants may be established. (Voigtlander-Wisconsin)
W70-00718

THE ISOLATION, PURIFICATION, AND NUTRIENT SOLUTION REQUIREMENTS OF BLUE-GREEN ALGAE,
Wisconsin Univ., Madison. Dept. of Botany.
Gerald C. Gerloff, George P. Fitzgerald, and Folke Skoog.
IN Symposium on the Culturing of Algae, Charles F. Kettering Foundation, Dayton, Ohio, p 27-44, 1950. 6 tab.

Descriptors: *Isolation, *Cyanophytes, *Nutrient requirements, Cultures, Lakes, Algae, Growth rates, Bacteria, Ultraviolet radiation, Actinomycetes, Hydrogen ion concentration, Nitrates, Potassium, Calcium, Magnesium, Iron, Organic matter, Nitrogen fixation, Volume, Streams, Water pollution effects, Eutrophication, Nuisance algae.
Identifiers: *Purification, Culture media, Microcystis aeruginosa, Aphanizomenon flos-aquae, Gloeotrichia echinulata, Coccochloris Peniocystis, Madison (Wis), Chicago Natural History Museum, Nostoc muscorun, Nutrient concentration, Wisconsin, Sulfur, Phosphorus.

Procedures and progress are described in isolating and culturing representative cyanophytes (blue-green algae) and making them bacteria-free. Each species isolated was designated as a permanent specimen in Chicago Natural History Museum collection. Coccochloris Peniocystis requires an unusually high pH for maximum growth. Systematic concentration variation of one element at a time of the basic culture solution showed that higher nitrate concentrations were solely responsible for increased growth. Relationship of phosphorus, sulfur, potassium, magnesium, calcium, and iron were tested. The demonstration indicates that 24 species of cyanophytes can be cultured continuously in inorganic solutions of known composition, evidences strongly that, as a group, they do not require organic substances or unknown factors for normal growth. It appears that nitrogen supply is an important factor in their growth under natural conditions. Coccochloris Peniocystis apparently does not fix atmospheric nitrogen. The

laboratory data probably cannot be applied directly to field conditions since concentrations of essential elements as well as volumes of solution from which algae extract them, are certainly important. Nevertheless, laboratory data should help considerably in determining requirements for optimum growth of cyanophytes in lakes and streams. (Jones-Wisconsin)
W70-00719

BACTERIOLOGICAL EFFECT OF SMALL BOAT WASTES ON SMALL HARBORS,
Washington Univ., Seattle.
Robert W. Seabloom.
Available from the Clearinghouse as PB-187 270, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Washington Water Research Center, July 1969. 20 p, 5 fig, 4 tab, 13 ref. OWRR Project A-024-WASH.

Descriptors: *Boat wastes, *Water pollution effects, Pollution, Fresh water, Seawater, Bacteriological contamination, Recreational watercraft, Washington, Water pollution sources.

Since abatement of land-based sources of pollution is beginning to become a reality, pollution from vessels takes on a greater importance. One aspect of this problem is the overboard discharge of wastes from small recreational craft. Many states and other agencies have taken action to prevent toilet waste discharges from boats into recreational waters. Federal legislation is needed to provide an effective control of wastes from small craft. Data are presented herein from a study of the small pleasure craft pollution of two small bays in the State of Washington. In one, the influence of small boat wastes on the bacteriological quality of fresh water was clearly demonstrated. A review of the present methods for handling sewage from small craft concludes that while additional research is needed to improve the technology, the present systems are considered minimally adequate.
W70-00722

WATER USE AND THERMAL POLLUTION,
EG and G, Inc., Las Vegas, Nev.
Frank C. Di Luzio.
Power Engineering, Vol 72, No 6, p 44-46, June, 1968. 2 tab, 1 graph.

Descriptors: *Aquatic life, *Balance of nature, Water utilization, Pollution abatement, Thermal pollution.
Identifiers: Power industries.

This paper deals with the problem of thermal pollution caused by use of water in power and other industries which use water for cooling and condensing purposes and then return it to waterways. Prevention and control of this waste heat is essential for the protection of present and future uses of our aquatic resources as the delicate ecological balance can be upset by just a small change in water temperature. About 70 percent of the industrial thermal pollution load in the United States today is caused by the steam-electric power industry and it is estimated that by the year 2000 about 7,140,000 billion Btu of heat will be rejected to the rivers compared to 1,164,000 billion Btu in 1958. Important elements of the problem are the increase in toxic effects of chemical pollutants, the increase in oxygen consumption of aquatic vertebrates, a decrease in dissolved oxygen concentration and a decrease in ability of assimilating other wastes. Technological solutions to the problem can be classified into five categories, namely, to minimize the effect of waste heat on the aquatic environment, to reduce waste heat produced in thermal generation, use the waste heat, methods to cool waste heat and non-polluting methods of power generation. (Upadhyaya-Vanderbilt)
W70-00742

THE EFFECT OF TEMPERATURE ON THE ACUTE TOXICITY OF PHENOL TO RAINBOW TROUT IN HARD WATER,
Water Pollution Research Lab., Stevenage (England).
V. M. Brown, D. H. M. Jordan, and B. A. Tiller.
Water Research, Pergamon Press, Vol 1, p 587-594, 1967. 4 fig, 2 tab, 23 ref.

Descriptors: *Phenols, *Toxicity, *Temperature, Resistance, Rainbow trout.

The resistance of rainbow trout to poisoning by phenol increases with increase in temperature up to at least 18 deg C, at which temperature the 48-hour mean lethal concentration (LC50) is almost twice that at 6 deg C. The LC50 value at 6.3 deg C was 5.4 milligrams per liter (mg/l), while at 18.1 deg C the LC50 value was 9.8 mg/l. A similar relationship exists with gas-liquor phenols, common waste products from carbonization of coal. The gas-liquor phenols were found to be more toxic at all temperatures studied than did the pure phenols. (Speakman-Vanderbilt)
W70-00746

THE EFFECTS OF THERMAL EFFLUENTS ON MARINE ORGANISMS,
Virginia Inst. of Marine Science, Gloucester Point.
J. E. Warinner, and M. L. Brehmer.
Air and Water Pollution Int J, Vol 10, p 277-289, 1966.

Descriptors: *Thermal pollution, Biological properties, Benthos, Phytoplankton, Temperature, Ecology, Heated water, Primary productivity.

The assimilation of carbon by the natural phytoplankton populations of the York River is affected by an artificial increase in water temperature. The main conclusion is that the greater the temperature rise, the greater the depression of production. At the highest experienced river temperatures, a 3.5 deg C increase in temperature was sufficient to depress production. This evidence suggests that the range of tolerance to temperature narrows toward the higher natural river temperatures, since only a small temperature rise results in a great reduction in phytoplankton production at river temperature above 25 deg C. The community composition and abundance of marine benthic invertebrates in the river were also affected by the thermal discharge over a distance of 300-400 m from the discharge. This affected area was minimized by the fact that the heated water was less dense and thus stratified. Primary production was forced to increase during the winter months, however, below the power plant. (Novotny-Vanderbilt)
W70-00747

EFFECTS OF INTRODUCTION OF HEATED WATER ON STREAMS (IN GERMAN),
Bundesanstalt fuer Gewasserkunde, Coblenz (West Germany).
M. Eckoldt, H. Knopp, and H. J. Liebscher.
Studie, bearbeitet im Auftrage des Bundesministers fur Gesundheitswesen, Apr 1969. Koblenz. 67 p, 31 ref.

Descriptors: *Thermal pollution, *Thermal power plants, Thermal capacity, Water temperature, Water utilization, *Water pollution effects, Self-purification, Fishing, Dissolved Oxygen, *Cooling water, Biochemical oxygen demand, Heated water, Aeration, Quality control, Water quality, Future planning, Water supply.
Identifiers: Artificial aeration.

This report summarizes possible negative effects of heated waters discharged from electric-steam power stations on streams. The report deals with the physical problems of the introduction of cooling water into streams, with its influence on the oxygen content, self-purification, biological properties, effects on water supply and shipping. The different types of cooling systems are discussed and their influence on cooling water demand is stated. The main conclusions of the report are: (1) Introduction of heated waters prevents ice formation, (2) One must take into account higher evaporation rates both in cooling towers and streams, (3) The decay coefficient for BOD has two optimum values, one at 30-32 deg C and the other at about 40 deg C, (4) Model investigations showed an increase of microbiological activity measured as BOD (2), (5) The introduction of cooling water at temperatures up to 30 deg C or heating of water up to 28 deg C could be tolerable if oxygen is supplemented. Artificial aeration has to be used in most cases, (6) Photosynthesis is influenced to a very low degree by the temperature increase, (7) A proposal for preparing maps of streams showing heat loads for future planning of steam-power stations is presented. (Novotny-Vanderbilt)
W70-00748

FISH AND FISHING AROUND TVA STEAM PLANTS.
Tennessee Valley Authority, Knoxville. Div. of Forestry Development.

TVA Report, Division of Forestry Development, 1969. 8 p.

Descriptors: *Warm water fishing, Temperature, Thermal pollution.
Identifiers: Average catch of fish.

Some of the heaviest fishing in the Tennessee valley takes place in the discharge channels and basins that receive warm water from the condensers of TVA steam plants. Various species have been observed in steam plant discharge channels at temperatures up to 100 deg F. John Sevier, with a discharge area of 6 acres, has the heaviest concentration of fish in the spring but throughout the year there were more fish in the discharge channel than in the river. Bluegill and channel catfish are the principal fishes and average catch of fishermen was 3.5 fish weighing 2.1 pounds per trip and success rate was 62%. Colbert, with fishing area of about 4 acres and discharge temperature of 9-13 degrees above lake temperature, has carpsucker, catfish, shad, carp as the principal fishes. February offered the best fishing followed by November and average catch was 2.5 fish and 1.1 pounds. Bull Run has a 3.5 acre basin and discharge temperature 10-13 degrees higher than lake temperature. The basin has 36 fish species. Both Kingston and Johnsonville discharge 10-14 degrees warmer water. The latter plant discharges to an 80 acre basin. The best months for fishing at Kingston are September, October, and May and average catch is 2.1 fish weighing 1.4 pounds per trip. At Johnsonville, the best months for fishing are October and January and average catch was 1.9 fish weighing 1.3 pounds per 3.8 hour trip. (Upadhyaya-Vanderbilt)
W70-00749

OIL POLLUTION OF THE SEA.
For primary bibliographic entry see Field 05G.
W70-00786

OIL POLLUTION OF THE SEA: THE EFFECTS OF POLLUTION.

Harv Int L J, Vol 10, No 2, p 321-323, Spring 1969. 3 p, 11 ref.

Descriptors: *Water pollution effects, *Damages, *Oil, *Wildlife, Real property, Navigation, Docks, Beaches, Recreational facilities, Marine fish, Marinas, Intertidal areas, Shellfish, Natural resources, Hazards, Aquatic environment, Fishkill, Ecology, Oily water.

Damage resulting from oil pollution falls into two categories; damage to the living resources of the sea and damage to property interests. Among the living resources affected are surface-feeding fishes and shellfish. The greatest problem may be the toxic effects on intertidal animals which serve as

food for larger fish. Large scale oil pollution also injures large quantities of water birds. Taken together, these damages adversely affect the entire chain of life in the marine environment. With respect to damage to property interests, the most noticeable damage is the fouling of recreational beaches and shorefront property. Large quantities of oil are washed ashore each year making beaches unfit for recreation and causing considerable economic loss. Oil spills also create fire hazards around docking facilities and hinder navigation. (See W70-00786). (Heckerling-Florida)
W70-00789

5D. Waste Treatment Processes

COST OF MUNICIPAL SEWAGE TREATMENT,
Illinois Dept. of Registration and Education, Urbana.
William C. Ackerman.
Technical Letter 12, Illinois State Water Survey, June 1969. 12 p, 6 fig, 3 tab.

Descriptors: *Cost analysis, *Construction costs, *Operating costs, *Sewage lagoons, *Operating costs, Mathematical studies.
Identifiers: *Illinois.

Estimating the costs of constructing and operating a municipal sewage treatment facility are possible from the data given. Such costs may be estimated from the regression lines of the figures included; confidence intervals of the best fit lines of regression are given such that the estimates are correct 16 percent of the time. Construction costs are indexed; the base of the index depended on geographical location. A table is included to facilitate comparison of construction costs. Annual unit operating costs in terms of dollars per population equivalent of wastes treated are presented. Also included is the cost of land which represents a significant proportion of capital investment for lagoon construction. Finally, a trend line of the construction cost indices is given so that forecasts may be made. An example is worked out to demonstrate how to utilize the data in estimating costs. (Grossman-Rutgers)
W70-00493

CHEMICAL INTERACTIONS OF WASTEWATER IN A SOIL ENVIRONMENT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
B. F. Hajek.
J Water Pollut Contr Federation, Vol 41, No 10, p 1775-1786, Oct 1969. 12 p, 9 fig, 20 ref.

Descriptors: *Soil disposal fields, *Water chemistry, *Waste water (Pollution), Water reuse, Biodegradation, Permeability, Soil chemical properties, Soil physical properties, Filtration, Clays, Groundwater movement.
Identifiers: Soil-wastewater relationships.

The performance of soil as a wastewater disposal and water reclamation resource often can be predicted from laboratory data which characterize wastewater, soil, and soil-wastewater relationships. Many parameters must be studied to assess fully the ability of soil to assimilate wastewater. Some of the significant wastewater parameters are: pH, pollutant form and concentration, concentration of accompanying ions, temperature, and volume disposal characteristics. Significant soil parameters are: bulk density, grain size distribution, mineral composition, exchange capacity, and resident exchangeable cations. Soil-wastewater interrelationships are characterized by batch equilibrium and dynamic soil solumn studies. Either theoretical or empirical approaches often can be applied to these data and used to predict pollutant migration rates and concentration distributions. (Knapp-USGS)
W70-00658

NEUTRALIZATION OF ACID MINE DRAINAGE,
Federal Water Pollution Control Administration, Athens, Ga. Southeast Water Lab.
David W. Hill.
J Water Pollut Contr Federation, Vol 4, No 10, p 1702-1715, Oct 1969. 14 p, 4 fig, 6 tab, 12 ref.

Descriptors: *Acid mine water, *Industrial wastes, *Water pollution control, Sulfates, Waste treatment, Neutralization, Sludge, Chemical precipitation, Chemical reactions.
Identifiers: Acid mine waste treatment.

When mining operations remove or penetrate the protective mantle of overburden of pyritic minerals, sulfides are exposed. In the presence of air and water, iron sulfides are oxidized to sulfuric acid and ferric sulfate. A study was designed to determine the possibilities of recycling sludge generated in acid mine drainage neutralization to achieve efficiency and chemical savings. Batch tests were performed on artificial acid mine drainage using ferric sulfate solution, limewater, slaked lime, and artificial dolomitic limestone. Below a pH of 4 previously precipitated sludge settled faster by recycle. Two-step neutralization provided modest savings for dilute solutions. About pH 4, dolomitic lime was a poor neutralizer. No significant benefit was achieved by recycling sludge for neutralization. (Knapp-USGS)
W70-00662

CHEMICAL PROCESSING OF WASTEWATER FOR NUTRIENT REMOVAL,
Stanford Univ., Calif. Dept. of Sanitary Engineering.
Rolf Eliassen, and George Tchobanoglous.
J Water Pollut Contr Federation, Vol 40, No 5, Part 2, p 171-180, May 1968. 10 p, 2 fig, 4 tab, 9 ref.

Descriptors: *Nutrients, *Waste water (Pollution), *Nitrogen, *Phosphorus, Ammonia, Ion exchange, Chemical precipitation, Electrochemistry, Distillation, Sorption, Reverse osmosis, Denitrification, Irrigation, Oxidation.
Identifiers: *Nutrient removal.

Nutrient removal from water, specifically the removal of nitrogen and phosphorus by chemical processes, is discussed. The nutrients can be removed from water by biological, chemical, and physical processes. The biological processes are: (1) algae stripping; (2) anaerobic denitrification; and (3) aerobic processes. The chemical processes include: (1) ammonia stripping; (2) ion exchange; (3) electrodialysis; (4) chemical precipitation; (5) sorption; (6) electrochemical treatment; and (7) oxidation. The physical processes are: (1) land application-irrigation; (2) reverse osmosis; and (3) distillation. In addition to these methods, chemical precipitation and sorption are used for phosphorus removal. The removal efficiencies for nitrogen and phosphorus compounds are 80-98% and 85-99%, respectively. The criteria for designing facilities for nutrient removal are given. (Carstea-USGS)
W70-00680

MECHANICAL RETRIEVAL OF WASTE OILS AND SOLIDS FROM WATER,
Edens Equipment Co., Chicago, Ill.
Robert W. Clyne.
Pap presented at 23rd Annu Meeting Amer Soc Lubricating Eng, Cleveland, Ohio, May 6-9, 1968. 7 p, 9 fig.

Descriptors: *Water pollution treatment, *Oily water, *Separation techniques, Water pollution control, Equipment, Mechanical equipment, Rotors.
Identifiers: Oil separation equipment.

The application of rotating cylinders for the recovery of oil spills from inland waterways and protected harbors, and for the retrieval of waste (free) oils from waste water is discussed. The general design details of permanent, fire-retardant, oil retention floating booms for marine and industrial applications are outlined. Recent developments include compact machinery for the separation of settled solids from waste water, cutting coolants, metal washing solutions, and quenching media. Ejection of the retrieved solids from the water is accomplished in the vertical plane. In contrast to pumped sludges, the solids content of ejected railroad sludges is about 40% by weight. The machine descriptions conclude with the presentation of a primary, mechanical, non-chemical oil-water-solids separator with the capability of reducing total oil content of about 85,000 ppm in waste water influent to an average of less than 100 ppm in the industrial effluent. (Knapp-USGS)
W70-00685

RECOVERY OF WASTE OIL USING FLOATING-TYPE SKIMMERS,
United States Steel Corp., Lorain, Ohio. Tooling and Methods Tubular Products Works.
Harold E. Hillyard.
Iron and Steel Engineer, Aug 1968. 4 p.

Descriptors: *Water pollution control, *Oily water, Industrial wastes, Waste water treatment, Waste disposal, Burning, Fuels, Lagoons.
Identifiers: Waste oil disposal.

Lubricant leakage and spillage that finds its way into a steel plant's sewers is recovered by means of a lagoon with floating-type skimmers. The waste oil is eventually used as a fuel at the plant boiler house. Thus, a satisfactory and economical means of disposal is provided in addition to the pollution abatement aspect. (Knapp-USGS)
W70-00686

PERFORMANCE OF NATURAL-DRAUGHT WATER COOLING TOWERS,
British Electricity Authority. Research Dept.
H. Chilton.
Proceedings of the Institution of Electrical Engineers, Vol 99, Part II, No 71, p 440-456, Oct 1952. 9 fig, 5 tab, 10 ref.

Descriptors: *Cooling towers, Heat balance, Heat flow, Heat transfer, Air circulation.
Identifiers: *Natural draft towers, *Cooling tower theory, Merkel's approximate integration, Water-air ratio, Performance coefficient.

The fundamental theory of natural-draught cooling towers is presented. After a brief general discussion, the work of previous investigators is summarized. A convenient approximate treatment of the transfer process due to Merkel is expressed as a nomogram. The conditions under which the approximations lead to appreciable errors are defined in a form suitable for practical use. The variation of air rate through a natural-draught cooling tower with design and operating conditions is defined by an approximate equation. It is shown that routine design and performance data can be reduced to two dimensionless quantities between which correlation would be expected on theoretical grounds. By considering numerous test results in conjunction with the theoretical relationships it is shown that all tests on a given tower can be represented by a single number, termed the 'performance coefficient' which is substantially independent of tower size and so offers a useful basis for comparison, interpolation and extrapolation between towers of comparable design. The application of the performance coefficient and a related quantity to the solution of practical problems is discussed and illustrated by worked examples. (Ross-Vanderbilt)
W70-00745

OIL POLLUTION OF THE SEA: CLEANING UP.

Harv Int L J, Vol 10, No 2, p 355-359, Spring 1969. 5 p, 18 ref.

Descriptors: *Water pollution control, *Cleaning, *Oil, *Pollution abatement, Detergents, Treatment, Beaches, Oceans, Chemical degradation, Chemcontrol, Project planning, Wildlife conservation, Steam.

Regardless of what type or how many preventative measures are used, oil spills will still occur. The problem then becomes one of how to clean up. The basic aim of any cleanup operation is either to collect the oil or to disperse it over as great a volume of open sea as possible so that bacterial action will eventually destroy it. Detergents are probably the most widely used material for treatment of oil pollution. Unfortunately, they often cause more damage to wildlife than does the oil itself. Attempts have been made to burn oil but this has proved impractical. Recently certain compounds designed to absorb or sink oil have been employed. Thus far these methods have proved to be much cheaper than others and less damaging to marine resources. Another technique useful especially for large spills is dispersant chemicals. One half gallon of such material will dispurse fifty gallons of oil. In relatively calm waters, booms and boats employing skimmers or suction pumps can be used to contain and remove small quantities of oil. Talc and other absorbers and steam cleaning have been used to clear beaches and rocks. To date, there has been a lack of coordination and inadequate knowledge of natural conditions which have resulted in disastrous consequences. (See W70-00786). (Heckerling-Florida)
W70-00796

5F. Water Treatment and Quality Alteration

ECONOMIC EFFECTS OF USING SUBSTANDARD QUALITY WATER IN WEBSTER AND OTHER COMMUNITIES IN SOUTH DAKOTA.
South Dakota State Univ., Brookings. Coll. of Agriculture and Biological Sciences.
For primary bibliographic entry see Field 03C.
W70-00727

5G. Water Quality Control

UNDERSTANDING THE WATER QUALITY CONTROVERSY IN MINNESOTA,
Minnesota Univ., St. Paul. Agriculture Extension Service.
John J. Waelti.
Minn Univ Agr Ext Bull No 359, July 1969. 27 p, 4 fig, 2 tab, 7 photo, 11 ref. OWRR Proj No A-019-MINN.

Descriptors: *Water quality, *Water pollution effects, *Water pollution sources, *Legal aspects, *Minnesota, Economics, Social aspects, Legislation, Governments, Water quality act.
Identifiers: *Minnesota water quality.

Water quality, quality standards, pollution sources, pollution effects, water quality control, and water quality legislation are explained in a publication intended for the use of interested voters. Efforts were made to state the subject matter simply while retaining a high degree of technical accuracy. A growing population with greater affluence, more leisure time, and greater mobility has imposed competing demands on the natural resources of Minnesota. Industrial development and urban growth have accelerated the deterioration of quality in Minnesota's lakes, streams, and ground water supplies. As a consequence of expanding demand, fresh water must be used and reused many times before it returns to oceans or to the hydrologic cycle. Each use generally results in deterioration of water quality. Competition for limited resources gives rise to controversy - and even in Minnesota, which is generally viewed as a 'water rich' state, water is sometimes a very limited resource depending on alternative uses. (Knapp-USGS)
W70-00430

REDUCING LAND SUBSIDENCE IN THE WILMINGTON OIL FIELD BY THE USE OF SALINE WATERS,
Long Beach Dept. of Oil Properties, Calif.
Robert L. Pierce.
Proc Amer Geophys Union Meeting, Apr 21-25, 1969, Pap H-68, 1969. 11 p, 10 exhibits, 5 ref.

Descriptors: *Injection wells, *Sea water, *Oil fields, *Subsidence, *California, Land subsidence, Withdrawal, Costs, Water pollution control.
Identifiers: Oil field subsidence correction, Water flooding (Oilfield).

The subsidence at Long Beach, California attributed to the Wilmington Oil Field development encompassed an area of 22 sq mi. Subsidence ranged from 2 ft to 30 ft, but the oil field is partially in the tidelands of Long Beach, California, and the Pacific Ocean provided a convenient supply of saline water necessary to correct subsidence by injection of sea water. The injection of saline water has successfully stopped the Long Beach Harbor area subsidence. By 1968, 2.1 billion barrels of saline water were injected into the Wilmington Oil Field. The bulk of this was ocean water produced from source wells open to sands 200 ft to 400 ft deep. The current injection rate of the field is 1.1 million barrels per day. Expanded use of the oil field's produced brine for injection is taking place and 550,000 barrels per day of this brine will replace source well water during 1969. The methods being used to clean the oil field's produced brine include: (1) filtration, (2) recycling through the shallow source water beds, and (3) blending with fresh or other saline waters. (Knapp-USGS)
W70-00447

AIR POLLUTION PUBLICATIONS - A SELECTED BIBLIOGRAPHY WITH ABSTRACTS, 1966-1968.
Library of Congress, Washington, D.C. Science and Technology Div.

For sale by Supt of Documents, US Government Printing Office, Wash DC 20402. Price $4.50. Dep Health, Educ, and Welfare Nat Air Pollut Contr Admin Bibliogr Rep, 1969. 522 p, 1,088 ref, 2 index.

Descriptors: *Bibliographies, *Abstracts, *Air pollution, Air pollution effects, Path of pollutants, Pollutant identification, Legal aspects, Social aspects, Public health.
Identifiers: Air pollution bibliography.

A selective bibliography of air pollution publication by National Air Pollution Control Administration (NAPCA) personnel and other persons and organizations receiving Federal air pollution funds was compiled by the Special Bibliographies Section of the Science and Technology Division of the Library of Congress. The bibliography contains over 1,000 entries spanning the literature of 1966-1968. Previous bibliographies, PHS Publication No. 979 (Revised 1964) and No 979 (Revised 1966) cover the years 1955-1963 and 1963-1966, respectively. The bibliography consists of references, with abstracts, to the literature originated by the staff and grantees of NAPCA on the subject of air pollution published during the period July 1966 through December 1968. The major portion of the material included consists of journal articles. In addition, books, monographs (handbooks, collections of papers delivered at conferences and symposia, etc.) and some report literature are also covered. While the bulk of the material is abstracted from English language publications, certain foreign items (mostly based on PHS grants awarded abroad) have also been included. (Knapp-USGS)
W70-00452

ECONOMICS OF AIR AND WATER POLLUTION.
Virginia Polytechnic Inst., Blacksburg. Donaldson Brown Continuing Education Center.
Virginia Water Resources Research Center, Virginia Polytechnic Institute, Short Course, Apr 28-30, 1969. 303 p, 17 articles, 2 append.

Descriptors: Water quality, Sewage effluents, Cost-benefit analysis, Pollution abatement.
Identifiers: *Economics of water pollution, Externalities.

This publication contains 17 articles, six of which deal with different aspects of water pollution. The areas covered are: externalities and water quality; public versus private goods; effluent changes; waste abatement and U. S. subsidies; selected issues of cost-benefit analysis; and, the measurement of economic losses from uncompensated externalities. One appendix lists the participants in the three day short course and the second appendix lists the biographical information of the speakers. (See also W70-00487 thru W70-00491). (Grossman-Rutgers)
W70-00486

COST-BENEFIT ANALYSIS: SELECTED ISSUES,
Virginia Univ., Charlottesville. Dept. of Economics.
Roland N. McKean.
Virginia Water Resources Research Center, Virginia Polytechnic Institute, Short Course, p 134-146, Apr 28-30, 1969. 13 p, 2 ref.

Descriptors: *Cost-benefit analysis, *Intangible benefits, *Intangible costs, Recreation facilities, Welfare (Economics).
Identifiers: *Externalities, Aesthetic values.

The problem in cost-benefit analysis is the valuation of inputs and outputs of a proposal. Subjective benefits are the spill over benefits or externalities of a project; i.e. beneficial consequences that do not pass through a market and for which there is no direct evidence regarding how much people are willing to pay for them. Possible ways of measuring aesthetic values are: comparing values of projects that contain certain aesthetic characteristics with those projects that do not; consult an expert panel. Recreational services are also subjective benefits, and one method of evaluating such services is to estimate differences in the amounts people are willing to spend for travel to and from the facility. Costs inflicted on others that do not pass through any market are therefore not voluntarily accepted because of an exchange. Such costs are difficult to evaluate. The value of these social benefits and costs depend on the welfare criterion accepted by society. Several virtues of cost-benefit analysis are discussed. (See W70-00486). (Grossman-Rutgers)
W70-00487

THE USE OF SUBSIDIES FOR WASTE ABATEMENT,
Clemson Univ., S.C. Dept. of Economics.
Hugh H. Macaulay.
Virginia Water Resources Research Center, Virginia Polytechnic Institute, Short Course, p 74-99, Apr 28-30, 1969. 26 p, 12 ref.

Descriptors: *Waste water disposal, *Quality control, Taxes, Depreciation.
Identifiers: *Subsidies, Externalities.

The allocation of water among different uses and the maintenance of high water quality are difficult to achieve because of cultural lags, uncertainties over ownership and the right to use streams, and externalities or social costs. Three systems for achieving optimum water quality are: a system of taxes or charges; a system of subsidies; and a system of rules and regulations. Four arguments for subsidies are: (1) pollution abatement equipment does not contribute to production; (2) pollution abatement benefits those downstream; (3) increased costs for abatement may drive some firms out of business; and (4) subsidies produce the same effects as charges do. Five arguments against subsidies are: (1) subsidies cause a misallocation of resources; (2) subsidies encourage greater output;

(3) subsidies do less to encourage the discovery of more efficient means of waste disposal than do charges; (4) the size of a subsidy is more difficult to determine than the amount of a charge; and (5) the form of a subsidy may produce misallocative effects. Two forms of subsidies are accelerated depreciation and tax credits. (See W70-00486). (Grossman-Rutgers)
W70-00488

EFFLUENT CHARGES,
Resources for the Future, Inc., Washington, D.C.
Clifford S. Russel.
Virginia Water Resources Research Center, Virginia Polytechnic Institute, Short Course, p 51-73, Apr 28-30, 1969. 23 p, 4 fig, 12 ref.

Descriptors: *Sewage effluents, *Prices, Decision making, Cost analysis, Management, Discharge (Water).

Economists are interested in effluent charges for they are interested in the manner in which market prices link the complex system of resource allocation. A theoretical examination of the role of market prices and the affect on effluent charges is given. To illustrate how market prices affect effluent charges a simple, illustrative case is explored. The conditions of optimal waste removal are illustrated. Cost functions, including total, average, and marginal costs, are utilized in the discussions. In applying a system of effluent charges the water manager is faced with institutional, political, technological, and economic problems. Such problems are discussed. Effluent charges are useful in the administration of schemes based on stream standards. (See W70-00486). (Grossman-Rutgers)
W70-00489

EXTERNALITIES AND THE QUALITY OF AIR AND WATER,
Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Economics.
Otto A. Davis, and Morton I. Kamien.
Virginia Water Resources Research Center, Virginia Polytechnic Institute, Short Course, p 15-20, Apr 28-30, 1969. 15 p.

Descriptors: *Water allocation (Policy), *Cost-benefit analysis, Real costs.
Identifiers: *Pareto optimality, *Externalities.

The costs and benefits associated with any desired level of air and water quality in the context of modern economic concepts are explained. In the allocation of resources, such as air and water, opportunity or real costs are incurred. The criterion of best allocation is pareto optimality which asserts that an allocation of resources is optimal if no reallocation could make some members of society better off without making others worse off. What should be produced and how much are questions not answered by pareto optimality, but by value judgements as transmitted through political processes. The market mechanism allocates resources which are compatible with consumer sovereignty. Perfect competition leads to a pareto optimality equilibrium mix of commodities. Pecuniary externalities exist when the buying decision of an individual affects price. Technological externalities exist when one decision unit affects the decisions of other units. Examples of both types of externalities are given. (See W70-00486). (Grossman-Rutgers)
W70-00490

PUBLIC VS. PRIVATE GOODS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Economics.
Charles Goetz.
Virginia Water Resources Research Center, Virginia Polytechnic Institute, Short Course, p 30-41, Apr 28-30, 1969. 11 p.

Descriptors: *Resource allocation, *Water pollution, Riparian rights.
Identifiers: *Public good, *Private good, Externalities.

Supposedly the normal profit-making incentives of individual trade serves to allocate resources (e.g. air and water) to their most valuable uses. Public goods are goods which embody an interdependency aspect which leads to a serious form of economic decision-making dilemma among individuals. Two conditions by which public goods are: (1) jointness - the ability of one physical unit of the good to provide services to more than one user; and (2) non-excludability-a defect in the property rights attached to a good. Water resources meet these two conditions of a public good. Non-excludability causes individual units to act as if they are unconcerned about pollution in the hope that another agent will clear up the problem. Interdependency also results in a bargaining difficulty called the hold out problem. Decisions as to the use of a public good such as water is based on individual actions. An example is used to explain the principles of a public good. (See W70-00486). (Grossman-Rutgers)
W70-00491

PANEL DISCUSSION ON WATER QUALITY CONTROL,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 06B.
W70-00502

PANEL DISCUSSION ON WATER QUALITY,
Northwest Pulp and Paper Association.
For primary bibliographic entry see Field 06B.
W70-00504

PANEL DISCUSSION ON WATER QUALITY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 06B.
W70-00505

MUNICIPAL CORPORATIONS-WATERS AND WATERCOURSES-EMINENT DOMAIN-POLLUTION OF WATER AS A 'TAKING' OF PRIVATE PROPERTY,
Brooks F. Crabtree.
Mich L Rev, Vol 40, No 5, p 750-752, Mar 1942. 3 p, 13 ref.

Descriptors: *Washington, *Water pollution, *Compensation, *Municipal wastes, Eminent domain, Cities, Judicial decisions, Public health, Riparian land, Land tenure, Sewage disposal, Rivers, Damages, Reasonable use, Legal aspects, Legislation, Public rights.
Identifiers: Constitutional law.

In Snavely v City of Goldendale, 117 P. 2d 221 (Wash 1941), plaintiff sued defendant city for damages caused to his land by the continual discharge of raw sewage into a river upstream from plaintiff's riparian land. The pollution rendered the water of the river unfit for domestic use and dangerous to health. The Supreme Court of Washington held that although the plaintiff failed to allege the necessary elements for a tort action against a municipality, under the state constitution he would have a valid cause of action for damages. The constitutional article provided that 'no private property shall be taken or damaged for public or private use without just compensation having first been made...' In some cases, public necessity and social welfare have been held to allow a municipality to dispose of sewage into natural watercourses even though a private owner would not have a similar right. In some states, a municipality may be given sewage drainage rights by statute, but this right cannot be exercised in such a manner so as to amount to an unconstitutional taking or damaging of the lower riparian owner's property. The practical solution is to give the municipalities a right of eminent domain and allow just compensation for damages. (Heckerling-Florida)
W70-00520

LIABILITY OF LANDOWNERS FOR POLLUTION OF PERCOLATING WATERS,
Robert E. Sharp.
Marq L Rev, Vol 39, No 2, p 119-134, Fall 1955. 16 p, 97 ref.

Descriptors: *Remedies, *Water pollution, *Percolating water, *Relative rights, Water law, Ground water, Subsurface water, Percolation, Subsurface runoff, Subsurface streams, Deep percolation, Ground water movement, Infiltration, Path of pollutants, Seepage, Penetration, Industrial wastes, Sewage, Waste water (Pollution), Legal aspects.
Identifiers: Trespass, Negligence, Nuisance, Strict liability.

The problems associated with pollution of percolating waters has increased with the rapid expansion of residential and industrial complexes into areas which see a high degree of percolated water use. The remedies available to the landowner who finds his water supply polluted fall into four basic areas: trespass, negligence, nuisance, and strict liability. Some jurisdictions do not hold to a right to undefiled waters, basing their opinions on the concept of damnum absque injuria which means a loss without injury. Other jurisdictions hold that there is an unlimited right to use percolating water, and contamination of such water so as to render it unfit for use when it comes onto a neighbor's land is a violation of the neighbor's rights for which an action can be maintained. Once the right to reasonable purity of percolating waters is postulated, the only remaining problem concerns the grounds on which the suit should be brought. Trespass is difficult to rely on, and negligence gives rise to sustaining the burden of proof. Nuisance has certain advantages as it is only necessary to show that the well has been polluted and that defendant has maintained a nuisance that has caused pollution. Strict liability makes the proof of a nuisance almost a matter of fact. (Moulder-Florida)
W70-00521

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 5 CONSUMPTIVE USE OF WATER: COMMON LAW RULES,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00532

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 9 STATE ADMINISTRATION OF WATER RESOURCES IN FLORIDA,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00536

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 11 THE LAW AND ADMINISTRATION OF POLLUTION CONTROL IN FLORIDA,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00538

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 13 A LOOK TO THE FUTURE,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 04A.
W70-00540

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
Ray F. Goudey.
Am Water Wks Ass'n J, Vol 39, No 10, p 1010-1020, Oct 1947. 11 p, 3 ref.

Descriptors: *Groundwater, *Water supply, *Water management (Applied), Conjunctive use, Water pollution control, Water pollution sources, Water pollution effects, Adoption of practices, Water conservation, Water resources, Standards, Water quality, Water supply, Water demand, Water requirements, Water utilization, Legal aspects, Water allocation (Policy).

General standards cannot be developed for the protection of all groundwater. Each problem must be solved on its own merits. State agencies have exercised some control over stream pollution since the 1860's. State legislatures have increased the powers of some of their administrative agencies, such as health departments and fish and game commissions, and have in some cases, created new departments. States have joined together in efforts to solve common stream pollution problems. These developments toward increased protection might be followed in regard to ground water protection. The ways that injuries to ground waters may adversely affect domestic, irrigational, and industrial supplies are discussed and examples are given to illustrate them. The necessity of supervisory control over public and industrial uses of ground water is stressed. (Kelly-Florida)
W70-00542

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
Ray F. Goudey.
Am Water Wks Ass'n J, Vol 39, No 10, p 1010-1015, Oct 1947. 11 p, 3 ref.

Descriptors: *Groundwater, *Standards, *Water quality, *Water pollution control, Administrative agencies, Water utilization, Water conservation, Water management (Applied), Water shortage, Water pollution sources, Water quality control, Drainage, Legal aspects, Water policy, Water resources, Planning, Water allocation (Policy), Natural resources.

Groundwater protection is connected with stream pollution control because percolating waters create groundwater which may again reach surface streams. The value of water as a natural resource is inestimable. Groundwater is usually restricted first to domestic, industrial, and irrigational uses and then to conveyance of sewage and industrial wastes underground. Control of pollution has been undertaken by various state agencies. Health departments have borne the bulk of pollution control in the past. Fish and game commissions have also been important agencies for state protection of streams. Industrialized states are adding specialized departments to such agencies. Interstate commissions, such as that created by the Tri-state Compact, also deal in protection of natural watercourses. Few states, however, have specifically included groundwaters in their protective statutes. It is recommended that pollution controls be enacted which encompass the boundaries of entire drainage areas, rather than political boundaries. Commissions should be established for these pollution control areas with powers to review pollution discharges, investigate and plan control works, and set standards of permissible pollution. (Kelly-Florida)
W70-00543

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
Ray F. Goudey.
Am Water Wks Ass'n J, Vol 39, No 10, p 1015-1020, Oct 1947. 11 p, 3 ref.

Descriptors: *Ground water, *Water pollution, *Water pollution control, *Standards, Water conservation, Water policy, Water management (Applied), Administration, Water pollution treatment, Reasonable use, Water quality, Water utilization, Non-consumptive use, Non-structural alternatives, Use rates, Legal aspects, Irrigation, Industrial wastes, Domestic water, Water supply, Water treatment, Classification.
Identifiers: *Artificial pollution, *Natural pollution.

Investigations conducted for ground water protection should differentiate between natural and artificial pollution. Discharge of sewage, use of water for irrigation, and use of fertilizers are among the common interferences by man with ground water supplies. Pollution may affect domestic, irrigational, and industrial supplies in a number of ways, in regard to quantity and quality of ground water available. Problems with pollution of ground water in some cases have become sufficiently critical to require control measures. All factors causing deterioration of the ground water supply should be noted. Some states require detailed plans by industries concerning methods of water treatment. Industry should be required to meet certain standards, but has certain rights which should not be ignored, such as the right to continued reasonable use of surface and ground waters without impairment of quality. The suitability of ground water for domestic, irrigation, or industrial use could be determined through a system of classification. (Kelly-Florida)
W70-00544

POLLUTION OF WATERS OF STATE.

Ind Ann Stat secs 68-517 thru 68-543 (1961).

Descriptors: *Water pollution control, *Indiana, *Eminent domain, *Programs, Legislation, State governments, Water conservation, Standards, Pollution abatement, Administrative agencies, Interstate, Methodology, Decision making, Regulation, Inter-agency cooperation, Pollutant identification, Cost sharing, Condemnation, Grants, Water pollution, Water quality.
Identifiers: *Water Pollution Control Act.

An administrative board known as 'The Stream Pollution Control Board of the State of Indiana' is created. The membership, powers, duties, organization, jurisdiction, and enforcement powers of the board are outlined. Procedures for the determination of pollution standards within the state and the legal sanctions available to insure compliance are provided. Included are both the procedure to be used in determining if violations have occurred and the penalties to be imposed for such violations. Additional powers are given to 'The Stream Pollution Control Board of the State of Indiana.' These powers include the right to represent the state in all matters relating to water pollution and the power to condemn land when necessary to control or eliminate water pollution. (Schram-Florida)
W70-00578

POLLUTION OF WATERS OF THE STATE: THE STREAM POLLUTION CONTROL BOARD OF THE STATE OF INDIANA.

Ind Ann Stat secs 68-517 thru 68-522 (1961).

Descriptors: *Water pollution control, *Indiana, *Administrative agencies, *Treatment facilities, Legislation, Programs, State governments, Water conservation, Standards, Pollution abatement, Methodology, Decision making, Pollutant identification, Supervisory control, State jurisdiction, Inspection, Evaluation, Waste disposal, Waste treatment, Administration, Water pollution, Water quality.

An administrative board known as 'The Stream Pollution Control Board of the State of Indiana' is created. The membership of the board, their compensation, their powers and duties, and the general organization of the board are detailed. The board is given jurisdiction to control and prevent pollution in the waters of this state. To this end, the board may bring any appropriate action in law or in equity in the name of the state of Indiana. After a hearing, the board may order any legal entity to acquire, construct, repair, alter, or extend such plants as may be necessary for the disposal or treatment of matter which is causing or contributing to the polluted condition of the waters of Indiana. The board is given the right to enter any private or public property for the purpose of inspecting and investigating conditions relating to water pollution and may receive all necessary assistance from any state institution to carry out the provisions of this act. (Schram-Florida)
W70-00579

POLLUTION OF WATERS OF STATE.
Ind Ann Stat secs 68-523 thru 68-534 (1961).

Descriptors: *Water pollution control, *Indiana, *Administrative agencies, *Standards, Legislation, Programs, State governments, Water conservation, Pollution abatement, Regulation, Decision making, Methodology, Pollutant identification, Public health, Quality control, Water pollution, Water quality.

Provisions for the determination of water pollution standards and legal sanctions available to insure the maintenance of such standards are set forth. The stream pollution control board is given the power to set these standards and make orders and regulations restricting further pollution. It is made unlawful to cause or allow any such pollution, and the board is given the power to serve notice upon any offender. A detailed procedure for enforcement of this act is outlined, and failure to comply with the orders of the board is made a misdemeanor. An additional fine is provided for each day such polluted condition continues. The power of the board extends to all lakes, rivers, streams, drainage ditches, roadside ditches, underground water, and all other surface and sub-surface water within the state. (Schram-Florida)
W70-00580

POLLUTION OF WATERS OF STATE.
For primary bibliographic entry see Field 06E.
W70-00581

GREAT LAKES BASIN COMPACT.
For primary bibliographic entry see Field 06E.
W70-00592

AN ENVIRONMENT FIT FOR PEOPLE,
For primary bibliographic entry see Field 06G.
W70-00603

NATURAL RESOURCES: QUALITY AND QUANTITY.
For primary bibliographic entry see Field 06G.
W70-00605

COMMENT ON ECONOMY OF WATER QUALITY MANAGEMENT AND POLLUTION CONTROL,
Cornell Univ., Ithaca, N.Y.
Louis Michael Falkson.
IN The Fresh Water of New York State: Its Conservation and Use, p 58-60, Wm C Brown Book Co, Dubuque, Iowa, 1967. 3 p. Edited by Hitchcock, Lauren B.

Descriptors: *Water pollution, *Water pollution control, Economics, Planning, Model studies, Optimization, Water quality, Costs.
Identifiers: Objective function, Benefit function, Loss function, Effluent charges, Water resource planners.

Non-economists in the water pollution control field tend to look for answers from the economist, or some sort of justification for decisions which have already been made. The economist's major potential contribution is the conceptual framework which he can provide for analyzing the problem of water pollution. The concept of optimization is a recurrent and basic economic problem. However, until benefit functions for water quality are esti-

mated, the economist's optimization model cannot be applied. If a second best solution is sought in which certain predetermined stream standards are met at least cost values, a system of effluent charges could achieve the same result and at considerably less administrative cost than existing practices. However, effluent charges are not entirely acceptable and the economist's alternative solutions to the problem are needed. (Loeb-Rutgers)
W70-00613

RESEARCH GOALS AND PROGRESS TOWARD THEM,
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese.
Environmental Quality in a Growing Economy, Baltimore, The Johns Hopkins Press, p 69-87, 1966. 19 p, 24 ref. Edited by Henry Jarrett.

Descriptors: *Environment, *Water pollution, *Effluents, *Public health, *Water resources planning, Marketing, Sewage, Management, Systems analysis, Damages costs, Industrial water, Hudson River, Streams, Water quality, Recreation, Air pollution, Waste water treatment, Transportation.
Identifiers: *Value-based rules, *Quality management, *Welfare economics, Public policy, Calculus, Optimality, Regional-scale opportunities, Utility.

The article is concerned with the useful study of environmental quality problems. Economic studies of these problems fall into four categories: conceptual and methodological studies, empirical evaluation studies, control systems studies, and studies bearing upon desirable institutional change. Knowledge of the economics of alternative systems of management when combined with technical knowledge can be the basis for great opportunities for research and constructive innovations in the areas of politics, law, and administrative organizations. In economic studies, optimum rules, standards, or other techniques for controlling environmental quality must result from analyses of values. If, as often happens, such value-based rules cannot achieve optimal environmental quality management, more direct and explicit collective action on a regional scale is indicated. Finally, appropriate research on how to design suitable institutional and organizational arrangements is needed to implement management systems and procedures suggested by economic and engineering analysis. This article is of interest to the water resource researcher due to the key role he plays in this economic analysis of the environment and also due to the extensive use of water resource studies in the planning process. (Murphy-Rutgers)
W70-00619

NEUTRALIZATION OF ACID MINE DRAINAGE,
Federal Water Pollution Control Administration, Athens, Ga. Southeast Water Lab.
For primary bibliographic entry see Field 05D.
W70-00662

A 5-YEAR SUMMARY OF THE REGULATORY CONTROL OF RADIOACTIVE MATERIAL IN ARKANSAS,
Arkansas State Dept. of Health, Little Rock. Div. of Radiological Health.
E. F. Wilson, and D. D. Snellings, Jr.
Radiol Health Data and Rep, Vol 10, No 8, p 341-345, Aug 1969. 5 p, 8 tab.

Descriptors: *Radioactive wastes, *Radiation, *Control, *Arkansas, *Regulation, *Monitoring, Safety, Radioisotopes, Inspection, Data collections, Data processing, Safety factors.
Identifiers: Division of Radiological Health.

The State of Arkansas has regulated the use of radioactive material for a 5-year period from 1964 through 1968. This report is a summary of regulatory activities of the Division of Radiological Health. The early (1964) regulatory inspections did not include sufficient data pertaining to the occupational exposure of individuals to radiation; however, the noted deficiencies of records and radiation safety are well documented. In early 1967, the Division of Radiological Health prepared all previous data for electronic data processing, and currently all regulatory inspections, as well as licensing activities, are prepared for electronic data processing on a routine basis. (Carstea-USGS)
W70-00678

MECHANICAL RETRIEVAL OF WASTE OILS AND SOLIDS FROM WATER,
Edens Equipment Co., Chicago, Ill.
For primary bibliographic entry see Field 05D.
W70-00685

RECOVERY OF WASTE OIL USING FLOATING-TYPE SKIMMERS,
United States Steel Corp., Lorain, Ohio. Tooling and Methods Tubular Products Works.
For primary bibliographic entry see Field 05D.
W70-00686

ECONOMIC CONSIDERATIONS RELATIVE TO WATER QUALITY,
William Whipple, Jr.
New Jersey Water Resources Research Institute Report, Rutgers University, New Brunswick, New Jersey. Paper presented at Fifth Annual American Water Resources Association Meeting, Oct 27-30, 1969. 16 p.

Descriptors: *Environmental effects, *Economic benefits, *Intangible benefits, *Water pollution effects, Economic efficiency, Economic justification, Benefits, Water quality, Public health, Recreation, Flow augmentation.
Identifiers: *Recreational environment, *Home environment, *Working environment, *Water quality benefits, Alternative means, Instream aeration.

The Water Resources Council states that benefits of water quality should be evaluated, but little progress has been made. Economists have contributed mostly to evaluation of water based recreation, which is only one of basic aspects. A recent report on the Potomac River based justification upon intangibles only; but this is not satisfactory. Systems analysis and comprehensive planning with multiple objective functions are illusory without evaluation of water quality benefits. Efficiency benefits of water quality could be evaluated under three categories: recreational environment, home environment, and working environment. Some intangibles would remain for consideration.
W70-00730

CONTRIBUTION OF PHOTOSYNTHETIC REAERATION TO TOTAL REAERATION OF THE PASSAIC RIVER,
For primary bibliographic entry see Field 05B.
W70-00731

THE CONSTITUTIONALITY OF EFFLUENT CHARGES,
Wisconsin Univ., Madison.
Silas Robert Lyman.
Thesis, University of Wisconsin, Madison, Wis, May 1969. 269 p. OWRR Project A-022-WIS.

Descriptors: *Legislation, *Riparian rights, *Water law, *Pollution abatement, Effluents.
Identifiers: *Private property rights, *Ad valorem tax, *Navigation provisions, Northwest Ordinance, Water pollution damage.

This thesis examines various constitutional objections which might be raised against effluent charges. An effluent charge was defined as a variable charge imposed on waste dischargers based upon the quality and quantity of waste they discharged and computed upon the basis of the approximate damage done to others by each unit of the effluent. The revenue raised would not be used to compensate injured downstream riparians, but either would defray the costs of a state-operated pollution abatement system or would become part of the general revenue. This definition was used because it raises the more serious constitutional questions. The constitutional questions examined were whether the charge constitutes an invalid exercise of the police power, whether it would constitute a taking of private property rights without compensation, whether the charge system would require an unlawful delegation of legislative power to an administrative agency, whether the charge amounts to an ad valorem tax which must be uniform, whether imposing the charge would violate the freedom of navigation provisions of the Northwest Ordinance and Wisconsin Constitution, whether the charge system would deprive riparians of their common law right to obtain court relief from damage caused by water pollution, whether municipalities had any grounds to object to state-imposed charges, whether the charges could be imposed as an exercise of the federal or state navigation servitude and whether they could be imposed by the state under its power as trustee to protect and manage the waters of the state for the benefit of the public. It is concluded that properly drafted effluent charge legislation would be within the state's constitutional power and would not be subject to the constitutional objections examined. (Davis-Univ of Wisconsin)
W70-00766

FEDERAL AIR AND WATER CONTROL: THE APPLICATION OF THE COMMERCE POWER TO ABATE INTERSTATE AND INTRASTATE POLLUTION,
Sidney Edelman.
Geo Wash L Rev, Vol 33, No 5, p 1067-1087, June 1965. 21 p, 122 ref.

Descriptors: *Pollution abatement, *Federal jurisdiction, *Clean Air Act, *Legislation, Federal government, Air pollution, Water pollution, Air pollution effects, Path of pollutants, Water pollution control, Water pollution sources, State jurisdiction, Administrative agencies, Navigable waters, Interstate, Governments, Interstate rivers, Riparian rights, Rivers and Harbors Act, Reservoirs, Atmosphere, Public health, Navigation, Aircraft, Legal aspects.
Identifiers: *Interstate commerce.

There must be a constitutional basis for such acts as the Federal Water Pollution Control Act and the Clean Air Act. Under these statutes, the fact that pollution crosses state lines is considered an appropriate basis for the exercise of federal authority, but federal action may be taken only upon request when the effects are limited to the state of the discharge. The validity of abatement of interstate water and air pollution hinges on the determination that the movement of such pollution is itself commerce. That commerce is not limited by economic considerations, that the nature of the material moved is not a factor, and the fact that it is not purposefully directed across a state line is immaterial; Congress can regulate interstate commerce to forbid the use of such commerce to promote the spread of any evil or harm to other states. Control over intrastate water pollution is justified by the appropriate jurisdiction of Congress over both interstate and intrastate navigable waters under the commerce clause, as well as by plenary powers over navigable waters that do not require a commerce nexus. (Douberly-Florida)
W70-00771

INTERSTATE COOPERATION IN RIVER BASIN DEVELOPMENT,
For primary bibliographic entry see Field 06B.
W70-00784

OIL POLLUTION OF THE SEA.

Harv Int L J, Vol 10, No 2, p 316-359, Spring 1969. 44 p, 176 ref.

Descriptors: *Water pollution, *International waters, *Oil, *Oceans, Legal aspects, Legislation, International law, Judicial decisions, Remedies, Damages, United States, Oil industry, Ships, Water pollution control, Water pollution treatment, Water pollution effects, Water pollution sources, Pollution abatement, Accidents, Wildlife conservation, Costs, Disasters, International commissions, Transportation, United Nations, Oil wastes.
Identifiers: *Oil pollution.

The purpose of this comment is to give a brief introduction to the problems caused by oil pollution of the sea and to the response given by the American and international community. Worldwide attention has focused on this problem due to unfortunate recent catastropes like the grounding of the oil tanker 'Torrey Canyon' and the escape of crude oil from the well off Santa Barbara. The author considers oil pollution of sea water from the following aspects: the sources of pollution; the effects of pollution; the response of the international community including the United States and multi-national conventions; the action of the United States; private remedies; the efforts of the oil and shipping industries; enforcement of control by detection; and methods of cleaning up. (See also W70-00787 thru W70-00796). (Heckerling-Florida)
W70-00786

OIL POLLUTION OF THE SEA: THE INTERNATIONAL RESPONSE.

Harv Int L J, Vol 10, No 2, p 323-332, Spring 1969. 10 p, 33 ref.

Descriptors: *International commissions, *Water pollution control, *Pollution abatement, *Oil, Jurisdiction, Legal aspects, International waters, Continental shelf, Oceans, Judicial decisions, Ships, Regulation.
Identifiers: Flag of convenience.

Beginning in the 1920's, the international community tried to find a solution to the oil pollution problem, but action was hampered because the urgency of the problem was not appreciated. More recently, conflicting national interests and problems of enforcement and jurisdiction have hindered a solution. The United States was one of the first proponents of an international conference to deal with oil pollution. Although a conference was held in Washington in 1926, no real progress came forth until the London conference in 1954. The conference promulgated a 15 point convention on oil pollution. The convention met with slow acceptance. In 1962, the London Conference was reconvened and a series of amendments were proposed for addition to the 1954 convention. The conference also adopted a number of resolutions to prevent oil pollution. In spite of these conventions and resolutions, problems of effective detection, prosecution, and civil liability remain. (See W70-00786). (Heckerling-Florida)
W70-00790

OIL POLLUTION OF THE SEA: THE INTERGOVERNMENTAL MARITIME CONSULTATIVE ORGANIZATION.

Harv Int L J, Vol 10, No 2, p 332-339, Spring 1969. 8 p, 19 ref.

Descriptors: *Water pollution control, *International commissions, *Oil, *United Nations, Pollution abatement, Regulation, Administrative agencies, Legal aspects, Oceans, Ships, Compensation, Damages, Project planning, Programs, Jurisdiction.
Identifiers: *Inter-governmental Maritime Consultative Organization.

The Inter-governmental Maritime Consultative Organization (IMCO) is a specialized agency of the United Nations. The IMCO Convention was drawn up by a United Nations Maritime Conference meeting in 1948, but it was not ratified by the requisite number of nations until 1957. IMCO has accepted the responsibilities given it by the 1954 International Convention for Prevention of Pollution of the Sea by Oil. It also undertook the oil pollution functions voted to the UN by a resolution of the 1954 London Conference. During its first ten years of existence IMCO was rather inactive. In 1967, IMCO met in London and initiated study problems in both legal and technical areas. IMCO has now organized a broad program to study the advisability of implementing a variety of new maritime regulations. The Legal Committee of IMCO has been studying various proposals for a multilateral treaty dealing with pollution liability. The draft seeks to establish the liability of a tanker owner for pollution damage caused by the escape of oil from his ship and to provide for an international system of compensation. (See W70-00791). (Heckerling-Florida)
W70-00791

OIL POLLUTION OF THE SEA: UNITED STATES ACTION.

Harv Int L J, Vol 10, No 2, p 338-345, Spring 1969. 7 p, 30 ref.

Descriptors: *Water pollution control, *United States, *Legislation, *Oil, Federal Government, Accidents, Judicial decisions, Pollution abatement, Legal aspects, Oil industry, Legislation.
Identifiers: Oil Pollution Act of 1961, Oil Pollution Act.

The first federal legislation designed to regulate oil pollution was the Oil Pollution Act passed in 1924. The act prohibited the discharge of oil except in cases of 'emergency' or 'unavoidable accident.' The courts had difficulty determining when, in fact, an accident was 'unavoidable.' Not until the United States' ratification, with reservations, of the 1954 London Conference did this nation move forward in the area. The Oil Pollution Act of 1961 implemented the 1954 Convention. Amendments to the 1961 Act were passed in 1966 under the title of Pollution of the Sea by Oil and implemented the provisions of the Convention as amended in 1962. In 1966, amendments were made to the Oil Pollution Act of 1924, making the 1924 Act unenforceable. Several major bills were presented to the 90th Congress. In 1967, the Senate passed the Federal Water Pollution Control Act Amendments of 1967. The Oil and Hazardous Substance Pollution Control Act of 1968 was proposed in the House. Neither of these bills was adopted because of strong oil industry opposition. (See W70-00786). (Heckerling-Florida)
W70-00792

OIL POLLUTION OF THE SEA: PRIVATE REMEDIES.

Harv Int L J, Vol 10, No 2, p 346-350, Spring 1969. 5 p, 19 ref.

Descriptors: *Remedies, *Water pollution, *Oil, *Damages, Adjudication procedure, Judicial decisions, Admiralty, Ships, Legal aspects, Jurisdiction, United States.
Identifiers: Liability, Common law.

Oil spillage may produce substantial damage to private littoral owners and users. The legal remedies now available to persons thus injured have three important aspects: jurisdiction, basis of liability, and scope of liability. The Admiralty Jurisdiction Act of 1948, has in the United States been held to apply to a ship's discharge of oil. Subject-matter jurisdiction would be compatible with several possible forums. The general maritime law of the United States primarily governs in such cases. Admiralty courts have drawn on a body of tort law from the common law of the states. Many common law principles are employed by the admiralty courts. While the measure of damages is also specially determinable by the admiralty courts, common law principles are generally used. One of the major limitations on damages is the value of the shipowner's interest in the ship and the freight 'pending', except where the injury is within the 'privity or knowledge' of the owner. In case of large scale loss, recovery is difficult because the liability fund has been all but destroyed. Imputing knowledge to the owner is also very rare. (See W70-00786). (Heckerling-Florida)
W70-00793

OIL POLLUTION OF THE SEA: THE EFFORTS OF THE OIL AND SHIPPING INDUSTRIES.

Harv Int L J, Vol 10, No 2, p 350-353, Spring 1969. 4 p, 11 ref.

Descriptors: *Water pollution control, *Oil industry, *Pollution abatement, *Insurance, Compensation, Damages, Ships, Waste water disposal, Wastes, Industrial wastes, Water pollution sources, Waste treatment, Waste disposal, Fuels.

The shipping and oil industry have not been completely oblivious to the dangers of oil pollution. The industries have been somewhat willing to enter into voluntary arrangements to control pollution. Recently, a number of preventative steps have been taken by the industry to reduce the discharge of oil into the sea. One of these measures is a system which allows tankers to burn crude oil and 'slope' instead of bunker fuel. The most promising technique to prevent pollution from ballasting and cleaning operations is the 'load-on-top' system. This system takes advantage of the fact that oil is lighter than water. After ballasting and cleaning operations, water is pumped out from the bottom of the mixture, leaving only a small amount of water mixed with the oil. Another example of industry cooperation is the recent organization of tanker owners, the International Tankers Owners Pollution Federation, Ltd, which administers a self-insurance plan to reimburse national governments and the tanker owner members for the cost of dealing with oil spillages. (See W70-00786). (Heckerling-Florida)
W70-00794

WATER POLLUTION CONTROL ACT.
W Va Code Ann, sec 20-5A-1 thru 20-5A-2 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Water quality control, *Standards, Legislation, State governments, Legal aspects, Public health, Water quality, Water resources, Water pollution, Wastes, Sewage, Industrial wastes, Sewage disposal, Water utilization, Quality control, Water pollution effects, Water pollution control.

It is the public policy of West Virginia to maintain reasonable standards of water purity and quality consistent with: (1) public health enjoyment; (2) the propagation and protection of animal and plant life; and (3) the attraction, development, and expansion of business and industry. As used within this article, the term 'water resources' includes all waters on or beneath the surface of the ground, whether percolating, standing, diffused or flowing, wholly or partially within the state, or bordering on the state and within its jurisdiction. The term 'pollution' shall mean the discharge or deposit, directly or indirectly, of sewage or waste in or near waters of the state in such quantity as does, or is likely to either contribute substantially to the contamination of such waters or contribute substantially to the alteration of the physical, chemical, or biological properties of any such waters when such alteration is directly or indirectly detrimental to public welfare, animal and plant life or makes the water unsuitable for commercial, recreational, or other legitimate uses. (Gabrielson-Florida)
W70-00806

OHIO RIVER VALLEY WATER SANITATION COMPACT.
Ind Ann Stat secs 68-601 thru 68-605 (1961).

Descriptors: *Ohio River, *Indiana, *Pollution abatement, *Interstate commissions, Water pollution control, Administration, Public health, Water resources, Inter-agency cooperation, Administrative agencies, River basin commissions, Programs, Interstate compacts, Water pollution, Water quality, Legislation, Standards, Sewage, Waste disposal, Solid wastes, Industrial wastes, Sewage treatment, Treatment facilities, Surveys, Planning.
Identifiers: Water sanitation districts.

The Ohio River Valley Water Sanitation Compact is adopted by Indiana. The purpose of the compact is to control future pollution and to abate existing pollution in the Ohio River drainage basin in order to eliminate the menace to the health, welfare, recreational facilities, and water supplies in said basin. The compact creates the 'Ohio River Valley Water Sanitation District' and establishes the Ohio River Valley Water Sanitation Commission to control water sanitation within this district. Although no single standard is imposed, the states agree that pollution by sewage or industrial wastes originating in a signatory state shall not injuriously affect interstate waters. Water that is to flow into the Ohio is required to be treated so as to completely remove settleable solids and remove not less than 45% of the total suspended solids. In addition, the Commission is empowered to impose a higher degree of treatment if necessary. The Commission is to draft uniform legislation dealing with pollution problems and is to consult with and advise the various states, municipalities, corporations, and persons with regard to the construction of plants for the disposal of sewage, industrial, and other waste. The Commission is empowered to issue orders to any municipality, corporation, or entity discharging sewage or waste into the Ohio River to abate, modify, or treat such discharge. (Schram-Florida)
W70-00826

STREAM POLLUTION.

Miss Code Ann secs 5931.01-5931.04 (Supp 1968).

Descriptors: *Interstate compacts, *Tennessee River, *Water pollution, *Mississippi, Interstate rivers, State governments, Legislation, Water districts, Water law, Pollution abatement, Legal aspects, Regulation, Standards, Control, Financing, Administrative agencies, Coordination, Planning, Political aspects, Costs, Cost sharing, Operating costs, Interstate commissions.

The Tennessee River Basin Water Pollution Control Compact is designed to promote effective control and reduction of pollution in the Tennessee River Basin through interstate cooperation and coordination. An interstate commission shall be created to establish the Tennessee River Basin Water Pollution Control District consisting of all areas drained by the Tennessee River. The Commission shall study the overall pollution problems, recommend legislation, render advice, and after public hearings, recommend minimum standards of water quality. No single standard will be appropriate for all areas or uses of water, and the Commission shall create appropriate standards for each area or use. A state pollution control agency may certify alleged violations of commission standards to the Commission. A hearing will be held, and appropriate recommendations will be made to the state pollution agency. If the recommendation is not followed, the Commission may issue orders that may be enforced in any court of competent jurisdiction. (Darragh-Florida)
W70-00835

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

A STUDY OF THE ECONOMIC IMPACT OF WATER IMPOUNDMENT THROUGH VALIDITY TESTING OF A COMPARATIVE-PROJECTOR MODEL,
Texas A and M Univ., College Station. Water Resources Inst.
John E. Pearson, and Kenneth E. Heideman.
Technical Report No 20, Water Resources Institute, Texas A and M University, Aug, 1969. 181 p, 53 tab, 53 ref, 5 append. OWRR Proj B-019-TEX.

Descriptors: *Economics, *Simulation, *Model studies, *Economic prediction, Economic impact, Computer model, Texas, Project planning, Reservoir stages, Simulation.

An established economic simulation model for reservoir development was applied to ten reservoir projects throughout Texas. The model as a predictor of economic impact was given a difficult test because of the diversity of geographic, economic, and social characteristics surrounding the reservoirs. Additional difficulty was provided because the reservoirs were in different development stages--Construction, Fill-up, and Post Fill-up. The simulation model was developed in a previous research effort on two central Texas reservoir areas--Belton Reservoir and Whitney Reservoir--and these areas were retained in the study for check purposes. A third reservoir area--Somerville Reservoir--for which earlier predictions were made was observed for differences between model predictions and actual development. A synthetic (or 'business activity') index was developed for measuring accuracy of the model in the thirteen reservoir areas. Initial applications pointed out weaknesses in recreation projection and total impact calculations. Only partial success with an early application of the model to all reservoir areas necessitated a detailed analysis of all internal model relationships. Revisions were incorporated by using primary data from on-site observations at each area and secondary data from various sources. A reapplication of the model showed the revisions had increased the accuracy for all but two reservoir areas. The revised simulation model provided a systematic and relatively accurate tool for measuring and projecting economic impact surrounding a developing reservoir area. The project data, the results and recommendations of the study are published as Technical Report No. 20 of the Water Resources Institute, Texas A and M University. Copies of the report have been sent to all persons cooperating and furnishing data for the study.
W70-00479

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 13 A LOOK TO THE FUTURE,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 04A.
W70-00540

PLANT SIZING FOR A SEASONAL PRODUCT DEMAND USING A LINEAR PROGRAMMING MODEL,
Ohio State Univ., Columbus.
Lawrence D. Vitt.
The Engineering Economist, Vol 14, No 1, p 25-40, Fall 1968. 16 p, 2 fig, 4 tab, 8 ref.

Descriptors: *Linear programming, *Investment, Mathematical models, Demand, Capital, Industrial production, Costs, Constraints, Planning.
Identifiers: *Plant sizing, *Seasonal product demand, *Linear programming model, Least cost scheduling, Capacity, Inventories, Substitution process, inputs.

This paper presents a method for determining least cost scheduling-investment programs for a firm with a seasonal product demand. The basic problems to be analyzed are the sizing and the timing of the firm's capital investments for plant and equipment. In investment appraisals, one of the most difficult problems is to determine the profitability of each alternative investment. The capital investment problem for a firm with a pronounced seasonal demand pattern lends itself to this type of analysis because the firm may substitute extra shift production, overtime production, or seasonal anticipation inventories for plant capacity. Thus, in developing its annual production plan a firm may substitute current production inputs for capital inputs in the form of buildings and production equipment. An Investment Analysis Model is developed to analyze the substitution process for the capital and the current inputs. A linear programming model of the firm's production smoothing problem is an important element in the Investment Analysis Model and is used to develop an optimum annual production plan for each alternative level of plant capacity. Such a model may prove applicable in the water area when planners are concerned with problems such as investment in water systems where the demand on these systems has significant seasonal variation. (Loeb-Rutgers)
W70-00604

RESOURCE QUALITY: NEW DIMENSIONS AND PROBLEMS FOR PUBLIC POLICY,
California Univ., Berkeley.
Michael F. Brewer.
Natural Resources: Quality and Quantity, p 197-212, University of California Press, Berkeley and Los Angeles, 1967. 16 p.

Descriptors: Water pollution, Natural resources, Energy, Oil, Recreation.
Identifiers: *Resource quality, *Public policy, Federal policies, Multiple uses, Federal resource agencies, Objectives, Organizational improvement.

The contemporary emphasis on highway aesthetics, the growing awareness of the problem of water pollution, our increased apprehension of the consequences to human health of smog, have all given rise to a broad public concern with the quality of our environment and its component resources. This concern has stimulated efforts to better understand the problems faced by users of particular resources, as well as by the general public, and to undertake correction measures. This new sensitivity to quality poses new problems for public resources agencies and requires new dimension of public policy. Federal policies and programs for natural resources operate through a complex network of organizations. The attempt to base public programs for resource management on our understanding of an ill-defined goal of quality imposes a heavy burden on the federal agencies, which are slow to respond because of their very complexity. In what way does resource quality enter the domain of public policy, and what are the implications for the programs of resource agencies. The author proposes to identify the requirements imposed on the federal resource agencies by considerations of quality and to suggest ways in which these agencies might accommodate such considerations more effectively in their programs and policies. The important role of water quality in the environmental problem and the responsibilities of the appropriate federal agencies with respect to water quality standards make this article of general relevance to the water researcher. (See W70-00605). (Loeb-Rutgers)
W70-00612

ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES BY DIGITAL COMPUTER,
Kentucky Univ., Lexington.
Thomas M. Rachford.
Water Resources Institute, Research Report No 1, 1966. OWRR Proj A-001-KY. 157p.

Descriptors: *Economics, *Flood control, *Digital computers, Population, Discount rate, Flood

damage, Costs, Flood plains, Floodproofing, Channel improvement.
Identifiers: Right-of-way value, population projection, open space amenities, sensitivity studies, Input, Output.

A digital computer program is developed in this project for selecting the optimum combination of flood proofing, flood-plain land use, channel improvement, and residual flood damage for a given flood-plain. The optimum policy is selected, based on economic efficiency, for each planning unit of the total flood-plain for each period of time called a planning stage. The program designed for the project was used to test the sensitivity of the optimum combination of measures to variation in discount rates, right-of-way value, population projections, value of open space amenities, adversion to large annual variation in flood damage, costs of restricting flood-plain land use, costs of flood proofing, and costs of channel improvements. It was also used to analyze the effectiveness of land use, flood proofing, and channel improvement used individually and in various combinations. (Loeb-Rutgers)
W70-00617

OPTIMAL WATER ALLOCATION: THE NORTH PLATTE RIVER,
North Carolina State Univ., Raleigh; and Chase Manhattan Bank, New York.
For primary bibliographic entry see Field 06D.
W70-00629

OPTIMUM ALLOCATION OF WATER RESOURCES BY MATHEMATICAL PROGRAMMING,
Rand Water Board, Johannesburg (South Africa).
David Stephenson.
J Hydrol, Vol 9, No 1, p 20-33, Sept 1969. 14 p, 2 fig, 11 tab, 5 ref.

Descriptors: *Water resources development, *Water allocation (Policy), *Water management (Applied), *Systems analysis, *Optimization, Computer programs, Mathematical models, Distribution patterns, Cost analysis.
Identifiers: Transportation programming, South Africa.

Optimization of water distribution plans is facilitated by transportation programming. For the purpose of compilation of an optimum water supply pattern, costs of conveying water from every possible source of water to each consumer within the system are calculated. The optimization is commenced by initially assuming arbitrary quantities along various routes, and then redistributing the quantities in a routine manner until no further improvement in cost is evident. Application of the technique to minimizing total cost of water conveyance is illustrated with an example. Extension of the method, using the principle of decomposition of linear programs, permits selection of optimum areas for development. Results of a large scale application to the Orange and Vaal River basins in South Africa are presented. (Knapp-USGS)
W70-00641

COMPUTER-ORIENTED METHOD OF OPTIMIZING HYDROLOGIC MODEL PARAMETERS,
Soil Conservation Service, Chickasha, Okla. Southern Plains Branch; and Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
Donn G. DeCoursey, and William M. Snyder.
J Hydrol, Vol 9, No 1, p 34-56, Sept 1969. 23 p, 4 fig, 5 tab, 5 ref.

Descriptors: *Mathematical models, *Optimization, *Parametric hydrology, *Systems analysis, Digital computers, Computer programs, Regression analysis, Mathematical studies, Statistical methods.
Identifiers: Hydrologic systems.

Hydrologic studies and significant advancement in hydrologic understanding are based upon interpretive analysis and hydrologic observations. The rational beginning point of such an inductive process is the construction of a conceptual model. Realistic hydrologic models are not normally simple forms, but the quantification and verification require specialized optimizing methods. Optimum values of the coefficients of mathematical models can be found by an iterative reduction of the residual error of estimates of the coefficient values. Orthogonal corrections to the coefficients are insured by using principal component analysis to regress the error term on a group of correction terms. A digital computer program capable of performing the optimization has been tested on 4 models of varying complexity and used on several fieldscale models. The optimized values of the coefficients are a function of the number of roots used in the solution. Convergence is not a function of the number of observations, feedbacks, random noise, or equation complexity. The optimization method discussed should be applicable in any discipline with significant inputs of interpretive data analysis. (Knapp-USGS)
W70-00642

THE USE OF EXPONENTIAL FUNCTIONS WHEN CONSTRUCTING THE LAWS OF THE DISTRIBUTION OF GEOGRAPHICAL AND HYDROMETEOROLOGICAL PARAMETERS (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Meteorology; and Moscow State Univ. (USSR). Dept. of Climatology.
For primary bibliographic entry see Field 02A.
W70-00657

6B. Evaluation Process

THE ROLE OF MARINE SCIENCES IN THE MULTIPLE USES OF THE COASTAL ZONE OF LAKE ERIE AND LAKE SUPERIOR,
National Planning Association, Washington, D.C. Center for Techno-Economic Studies.
For primary bibliographic entry see Field 02L.
W70-00457

ECONOMICS OF AIR AND WATER POLLUTION.
Virginia Polytechnic Inst., Blacksburg. Donaldson Brown Continuing Education Center.
For primary bibliographic entry see Field 05G.
W70-00486

COST-BENEFIT ANALYSIS: SELECTED ISSUES,
Virginia Univ., Charlottesville. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W70-00487

INSTITUTIONAL FACTORS AND THE TEXAS WATER PLAN,
Texas A and M Univ., College Station. Water Resources Inst.
Warren L. Trock, and Clarence W. Jensen.
Western Agricultural Economics Association, Annual Meeting, Texas A and M University, 1969. 10 p, 17 ref. P.L. 88-379 (Texas). OWRR Proj B-025-TEX.

Descriptors: *Governments, *Jurisdiction, Economic feasibility, Technical feasibility.
Identifiers: *The Texas Water Plan, 1969.

The Texas Water Plan of 1969 presents problems of engineering, economic feasibility, cost-sharing, financing and water pricing, and institutional arrangements. The federal, state, and local governments are concerned with these problems. The federal government will be concerned with matters that affect several states and regions such as water surplus apportionment and cost sharing. The state government is concerned with state-wide problems such as the allocation of water among various uses, pricing policies, and management. Local and county authorities are more concerned with problems which serve local interests such as local water supply, guarding their investments in facilities, and protecting their positions as debtors. (Grossman-Rutgers)
W70-00492

FEDERAL NATURAL RESOURCES DEVELOPMENT: BASIC ISSUES IN BENEFIT AND COST MEASUREMENT,
George Washington Univ., Washington, D.C.
Jack L. Knetsch, Robert H. Haveman, Charles W. Howe, John V. Krutilla, and Michael F. Brewer.
Natural Resources Policy Center, The George Washington University, Washington, D.C., May 1969. 12 p.

Descriptors: *Cost-benefit analysis, Social impact, Planning, Federal Government.

Water resource projects by governmental agencies absorb inputs and produce outputs. Therefore, these projects provide the opportunity to measure the benefits and costs. In public projects, all the costs and benefits must be evaluated besides the receipts or disbursements of the agency undertaking the project. Six principles as to the measurement of benefits and costs, based on appropriate economic concepts of social benefits and social costs, are explained. (Grossman-Rutgers)
W70-00494

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS: A SELECTED ANNOTATED BIBLIOGRAPHY,
Tennessee Valley Authority, Washington, D.C.
Hubert Hinote.
Center for Business and Economic Research, The University of Tennessee, June 1969. 148 p.

Descriptors: *Bibliographies, *Reviews, *Cost-benefit analysis, Water control, Navigation, Quality control, Recreation, Supply.
Identifiers: Land-value enhancement.

This publication contains a bibliography dealing with benefit-cost analysis of water resources. Each reference is followed by a short note on its contents. The areas covered by the references are: basic works, flood control, navigation, water quality (pollution) control, recreation, water supply, land-value enhancement, and some related bibliographies. Also included are an author index and an index to government and other agency publications. (Grossman-Rutgers)
W70-00495

SUCCESS OF WATERSHED DEVELOPMENT IN LOCAL COMMUNITIES,
P. Thomas Cox.
Natural Resources Journal, Jan 1969, Vol 9, p 23-34. 4 tab, 1 fig.

Descriptors: *Watershed management, *Analysis, Statistical methods, Evaluation, Variability, Regression analysis, Social values, Economics, Decision-making.
Identifiers: Socio-economic analysis, Multiple discriminant analysis, General factor analysis, Multiple regression analysis.

Primarily concerned with the assessment of success and failure, followed by adjustments and adaptations to these findings in watershed projects, this study attempts to discover the causes of disparity in rate of development found between upstream watershed projects. It is hypothesized that social economic data are reflections of man's reactions to his environment, and that if this is true, it is possible to analyze and observe data of community variables in such a way as to categorize or classify communities according to their performance, with performance defined as ability to achieve specified

goals which, in this case, would be development of the community's water resources. The hypothesis is tested by classifying the rate of progress of 115 upstream watershed development projects in Oklahoma, based on the time lag for a project to process through the various stages of development. With rate of progress as the dependent variable and 22 selected socio-economic variables as the independent variables, multiple discriminant analysis, general factor analysis, and multiple regression analysis are applied to the data. In addition, a sample survey of persons actually engaged in project development at the local level is carried out. Through these procedures it is possible to identify and assess factors contributing to the success of development. Differences do exist in rates of progress by communities, and these differences when known, are useful in the establishment of priorities, in providing information for decision-making, and in further study of the reasons for disparity in rates of development. (Marriott-Chicago)
W70-00497

FORECASTING REGIONAL ECONOMIC GROWTH: SOME PROBLEMS AND PITFALLS,
Oregon Univ., Eugene.
James N. Tattersall.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 75-83, Mar 1964.

Descriptors: *Regional analysis, Economic justification, Statistical methods, Population distribution patterns.
Identifiers: Location theory, Outmigration.

There are three broad statistical frameworks generally used today in regional economic studies: there is the regional accounts approach; the input-output approach; and the economic base approach. These techniques are useful devices for classifying information. There is, however, no one simple technique for making predictions or policy judgements almost automatic. Some shortcomings of existing regional studies are noted: (1) the method of defining regions, particularly group-of-states regions. A broad regional study can easily miss significant intra-regional changes; (2) population assumptions based on projecting past trends which accepts population growth as an independent variable. Obviously if employment opportunities do not occur, population growth will be smaller; (3) the assumption that outmigration is undesirable; (4) growth industry hypothesis which fails to recognize the crucial role of production and transportation costs in locational decisions; (5) straight line projections of economic indicators. The characteristics of what the author contends are good regional studies are: (1) use of various statistical frame works and techniques which are not substitutes for analysis; (2) use of location theory; (3) use of economic analyses that are consistent with forecasts for other regions and are sensitive to intra-regional variations; (4) data sufficiently disaggregated; and (5) value judgements about goals of regional growth are clearly specified. (Starr-Chicago)
W70-00498

AREAS OF DEFICIENCY AND RESEARCH NEEDS IN WATER RESOURCE PLANNING,
Henry Stewart.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 101-105, Mar 1964.

Descriptors: *Research and development, Alternative costs, Economic analysis, Water resource management, Political aspects, Social aspects, Public benefits.
Identifiers: Alternative benefits.

Lack of adequate communication is seen as one of the greatest deficiencies in modern water resource planning. Another deficiency in water resource planning is the tendency to use the degree of economic justification as a deciding factor in plan formulation. The benefit-to-cost ratio tends to be maximized at the expense of maximization of conservation, development, and beneficial use of the water resource. To minimize this deficiency, planners must look beyond economic analysis and the benefit-to-cost ratio and recognize current urgent needs and political facts of life so that they can select those projects to be accepted and supported by the public. Problems in research are outlined: (1) who will pay the bill for research - the general public and the ultimate beneficiary of proper water planning, or the immediate user; (2) the question of pure research versus applied research; and (3) economic analyses which do not include comparisons of specific individual projects and alternative projects. (Starr-Chicago)
W70-00501

PANEL DISCUSSION ON WATER QUALITY CONTROL,
Oregon State Univ., Corvallis.
Malcolm H. Karr.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 46-47, Mar 1964.

Descriptors: *Water quality, Research and development, River basin planning, Stream degradation.

The need for developing practical water quality objectives is pointed out. These objectives shouls be realistic for each area under consideration, since few standards would have nationwide applicability. Even individual streams are considered to require different standards for different sections. The successful development of suitable water quality objectives for river basin planning is dependent upon basic and applied research in the field of water. Basic research should be a function of the universities; applied research could properly be undertaken by regional and national laboratories and agencies. (Starr-Chicago)
W70-00502

CONSERVATION AND SOCIAL OBJECTIVES OF COMPREHENSIVE RIVER BASIN PLANNING,
Bureau of Outdoor Recreation, Washington, D.C.
Fred J. Overly.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 48-53, Mar 1964.

Descriptors: Recreation, Benefit-cost ratio, River basin planning, Economic impact, State planning.

The role and objectives of the Bureau of Outdoor Recreation in Comprehensive River Basin Planning is reviewed. Public Law 85-470 established their mission: (1) determining the outdoor recreation needs of the American people in the years 1976 and 2000; (2) determining the resources of the nation to satisfy the need; and (3) determining the policies and programs to insure that the needs are adequately met. A nationwide plan has been developed and technical assistance is given to the States in the preparation of outdoor recreation plans. State plans are a prerequisite for a state to obtain financial assistance under the Land and Water Conservation Fund. Funding would come from recreation users through entrance fees at certain Federal areas; from fuel tax paid on gasoline used in motorboats; from proceeds of sale of Federal surplus real property; and from advance appropriations which would be repaid from the Fund over a period of time. The Bureau's chief responsibility is the integration of recreation planning with other resource planning. While the intangible benefits of recreation are difficult to evaluate on a monetary basis, it can be done. Recreation is a major factor in the economy of the country and particularly in certain regions of the country. In the Pacific Northwest, recreation ranks third in the region's economy. ORRRC determined in its study that recreation contributed more than 20 billion dollars annually to the nation's economy. (Starr-Chicago)
W70-00503

PANEL DISCUSSION ON WATER QUALITY,
Northwest Pulp and Paper Association.
Donald J. Benson.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 43-45, Mar 1964.

Descriptors: *Water quality, Water use, Water demand, Water law, Downstream effects, Industrial wastes.

Contention of the author is that the use of water means a change in water quality, and changes in water quality are almost never an improvement. Therefore, increased demands for water usually means a deleterious effect upon the quality of the water resource. The adoption of severly limiting criteria such as a water quality objective for drinking water is seen as being harmful to any comprehensive plan, since the use of water by industry is inevitable and since the effluents produced by industry are incompatible with drinking water quality. Planners must therefore allow for this use. The accepted rules of water quality control - 'protection of downstream beneficial use' and 'one legitimate use shall not supplant another' are viewed as reasonable rules. They are not adequate, however, for determining what bodies of water shall be allowed to have more use than others. Nor are they enough to establish reasonable criteria for heavy industrial use that will not tend to block future expansion of industry into an area. The establishment of water quality control law based on water criteria objectives rather than set standards is proposed as the method of implementation of adequate plans. (Starr-Chicago)
W70-00504

PANEL DISCUSSION ON WATER QUALITY,
Geological Survey, Washington, D.C.
L. B. Laird.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 40-42, Mar 1964.

Descriptors: *Water quality, River basin planning, Technological impact, Research and development.

Basin planning has one goal, for the full development of water resources, the full economic development of the basin while maintaining a suitable quality of water to meet the varying demands. The basin planner needs to know: (1) the present quality of the water resources; (2) data on the current water qualitydemands; (3) future demands; (4) knowledge of the impact that changing water use will have on water quality; and (5) knowledge of the hydro-geologic system of the basin. Research needs outlined are: relationships between solutes, sediments and biota; influence of municipal waste disposal; and influence of reservoir storage on water quality. (Starr-Chicago)
W70-00505

WATER QUALITY OBJECTIVES,
Keith S. Krause.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 34-37, Mar 1964. 1 tab.

Descriptors: *Water quality, Water utilization, Economic feasibility, Standards reliability.
Identifiers: *Goals and objectives.

Author defines water quality as being good when it does not interfere with legitimate uses and as being poor (in various gradations) when it interferes with some or many uses. While it is difficult to describe what is really meant by water quality, the author feels it is necessary to develop a rational means of measuring water quality and what objectives or goals shouls be considered. Congress has established two laboratories for determining the detrimental effects of pollutants. Since not all the necessary scientific information on these pollutant-

use relationships are known, goals will have to be determined in a subjective manner. Furthermore, it will be necessary to judge the established goals as they relate to present and probable future water uses at specific locations. In attempting to make the judgments, user groups and regulatory groups are examining the evidence and helping to establish desirable objectives. The development of an economic rationale for determining the economic value of comparative water qualities is seen as an essential process in the preservation and conservation of the water resource. (Starr-Chicago)
W70-00506

A MEASURE OF WATER RECREATION BENEFITS: THE MERAMEC BASIN EXAMPLE,
Edward L. Ullman.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 15-29, Mar 1964. 3 tab, 7 fig.

Descriptors: *Recreation, Benefit-cost ratio, Reservoirs, River basin planning.
Identifiers: Meramec Basin Project.

A description of an approach to assigning a value to an intangible activity such as recreation, using the Meramec Basin Project, outside of St. Louis, as an example. A principal conclusion reached is that the benefits from recreation vary from place to place, in relation to size of market and lack or alternative opportunities, and that, therefore, recreation is not as important a purpose for some regions as it is for others. In St. Louis, an area where there is little alternative opportunities for water recreation, it was necessary to determine if there was justification for creating a large body of water for such a purpose. Surveys were conducted to see where St. Louis residents were presently going for their water recreation and to determine their reactions to a new reservoir closer to home. An attendance prediction model was developed from the results of the surveys, and this in turn, was translated into dollars of benefits. Dollar values were assigned to savings in mileage, and time, and estimates were made of what monetary benefits would derive from an admission charge. A figure of $4,728,000 was derived as the total figure of benefits to be derived from the creation of a new reservoir. It is important to note a one visitor day benefit figure cannot be developed; each reservoir requires a different figure for individual benefits as well as attendance prediction. (Starr-Chicago)
W70-00507

PERSPECTIVES ON ENVIRONMENTAL PLANNING AND RESOURCE DEVELOPMENT,
Michigan State Univ., East Lansing.
Sanford S. Farness.
IN Water Resources Planning in Illinois, Illinois Board of Economic Development, Illinois Conference on Water Resources Development, 1964. p 6-12.

Descriptors: *Environmental engineering, Decision making, Water resources development, Social aspects, Regional analysis, River basins.
Identifiers: *Environmental planning, Regional planning.

The recent regional spread of urban settlement, commuting patterns, labor supply and market areas are compelling cities to be concerned with regional factors in meeting the increased needs for urban land, water disposal, flood control, forests, parks and open space. Water resources and water-connected problems are now strategic factors in environmental design. The strategic importance of water resources as a man-environment relationship now and as a critical factor in future development raises to new prominence the river basin region. In this framework, the elements and systems of nature and society emerge as interdependent factors. Environmental planning, which includes physical, biological and social space planning is set squarely in a cultural value, human community and landscape-creating context and is slowly being defined as a process. The key problems to be overcome are: 91) that concepts and methods utilized in projecting population and economic change are inadequate and ignore policy-making determinants; (2) unbalanced economic perception and thinking based upon meeting the demands of production and consumption; and (3) exclusion in the planning process of intangibles such as justice, freedom, emotional and ecological fitness, and beauty. (Starr-Chicago)
W70-00510

THE FEDERAL COMPREHENSIVE SURVEYS,
Roy T. Dodge.
IN Water Resources Planning in Illinois, Illinois Board of Economic Development Illinois Conference on Water Resources Development, p 12-14, 1964.

Descriptors: *Water resources development, *River basin development, Economic efficiency, Project planning, Social function.
Identifiers: *Upper Mississippi River Basin, Economic base studies.

A brief background of river basin planning is presented. Comprehensive basin planning is one phase of the General Investigation program of the U.S. Army Engineer Corps; the other phase is the specific detailed project surveys designed for project authorization and construction. A description of the planning effort for the Upper Mississippi Basin is given. Three general aspects of this effort are: (1) planning objectives; (2) methodology of planning; and (3) current status and anticipated results. In terms of the first aspect, the ultimate objective is to contribute to the improvement of the economic and social climate of the Upper Mississippi Valley through: (1) increased production of agricultural products through control of flood waters and soil erosion and proper land use; (2) storage of surface waters to reduce flood damage and provide water supply; and (3) provision of fish and wildlife and recreation areas. The methodology employed for the Upper Mississippi Basin consists of four principal phases: (1) appraisal of the current and prospective economic potential of the basin; (2) the projections for this potential is then translated into needs for the control, regulation and use of water and related land resources; (3) examination of the water and land resource available in the basin to meet projected needs; and (4) comparison of the resources and land capabilities with the needs developed from economic projections which results in an assessment of the potential improvements best suited for the timely development of those resources to satisfy present and projected needs. The planning effort is accomplished through the efforts of eight work groups organized on a functional basis. (Starr-Chicago)
W70-00511

PLANNING FOR WATER RESOURCE DEVELOPMENT: THE FORMULATION OF A STRATEGY,
Northwestern Illinois Planning Commission.
Matthew L. Rockwell.
IN Water Resources Planning in Illinois, Illinois Board of Economic Development Illinois Conference on Water Resources Development, p 15-16, 1964.

Descriptors: *Water resources development, Groundwater, Surface waters, Land use.
Identifiers: *Metropolitan planning, Northeastern Illinois.

The unique characteristics of metropolitan areas make it desirable to approach planning for water management on a metropolitan scale. There are at least four characteristics of metropolitan areas which distinguish them from other types of planning units: (1) metropolitan areas represent economic units with internal linkages strong enough to offset the divisional features of the physical environment, e.g., drainage basins and surface streams; (2) metropolitan areas give rise to a wide diversification of demands that are concentrated in a limited area and which frequently exceed the available resource; (3) myriad of governments having fragmented authority from the standpoint of both area and functional jurisdiction; (4) the large concentration of population and industry in metropolitan areas and the accompanying human and financial resources makes possible bold programs for management of water resources. Northeastern Illinois with an average daily inflow of about 10 billion gallons per day appears to be rich in water resources. However, the capture and efficient use of this continuously renewing resource can be realized only through comprehensive water resource development and management. The major elements of the metropolitan water system which have potential for management and which are of sufficient quantity to be of regional significance are: surface water inflow from beyond the metropolitan area, groundwater, and surface water runoff from rainfall and evapotranspiration. Seven policies are outlined which are the basis of a strategy of development and management of the water resouce in Northeastern Illinois. The seven policies will be reflected in a land-use plan being developed by the Northeastern Illinois Planning Commission. (Starr-Chicago)
W70-00512

MAKING THE STATE AN EFFECTIVE PARTNER IN WATER DEVELOPMENT,
Cornell Univ., Ithaca, N.Y.
Leonard Dworsky.
IN Water Resources Planning in Illinois, Illinois Board of Economic Development, Illinois Conference on Water Resources Development, p 16-21, 1964.

Descriptors: *Federal-state water rights conflict, *State jurisdiction, State governments, Local governments, Water resource development.
Identifiers: National needs, Regional needs.

The history of the role of the States in water resource development is presented. Areas of involvement in the past included: (1) canals and internal improvements; (2) land reclamation, drainage and improvement of water courses; (3) water supply; and (4) water law. Today states play a broad role within the federal system in connection with many aspects of water resources planning, although this role has been largely overshadowed by Federal water resource development efforts. The areas of involvement today include: (1) municipal and industrial water supplies; (2) agricultural water supplies; (3) water pollution control; (4) soil and water conservation; (5) watershed development and recreational development; (6) basic data collection; (7) legislative provision for water and related land developments at local and regional levels; and (8) interstate cooperation on water allocation, water supply and pollution control. Most of these roles have been enacted, for the most part, largely within state boundaries, often with inadequate coordination between state agencies, and with unclear objectives. Recommendations are made for strengthening state water resource programs. A strong state program is seen as reflecting three aspects: (1) the desires and needs of its citizens; (2) a greater responsibility to insure that local government effort is timely and consistent with the state development program; and (3) a relating of the state needs to longer regional and national needs. (Starr-Chicago)
W70-00513

DEVELOPING POSITIVE PUBLIC ATTITUDES FOR WATER RESOURCE DEVELOPMENT,
Frank P. Zeidler.
IN Water Resources Planning in Illinois, Illinois Board of Economic Development, Illinois Conference on Water Resources Development, p 21-25, 1964.

Descriptors: *Attitudes, *Political aspects, *Social aspects, Research and development, Technology.
Identifiers: *Voluntary organizations.

As a result of rapid population and industrial growth, water has become the Nation's No. 1 natural resources problem. The author's contention is that the main problem in water resource development is how to motivate enough people to do something about the problem. The reluctance of local government is often accompanied by the unwillingness of state government agencies to carry out the mandate of their statutory authority to enforce water pollution control and abatement of nuisances. This enaction on the part of local and state government places pressure, therefore, on Congress for water pollution control. The author views an aroused public as the prime requisite for getting both public officials to act and for private action. Voluntary organizations supply the support that the legislator needs to favor a cause and promote legislation. Political leaders, however, must not await the initiation of action by voluntary organizations. They too can institute change by educating the public, particularly during political campaigns. Another source for positive actions can originate with the technical people and their organizations. These organizations possess detailed knowledge of water resource development problems and must speak out on the problems and make suggestions for their solution. (Starr-Chicago)
W70-00514

WATER RESOURCE INFORMATION FOR PLANNING AND MANAGEMENT,
Illinois Geological Survey.
John C. Frye.
IN Water Resources Planning in Illinois, Illinois Board of Economic Development, Illinois Conference on Water Resources Development, p 40-42, 1964.

Descriptors: *Illinois, *Water resources development, Geologic investigations.
Identifiers: *Illinois State Geological Survey, *Water resources planning.

Described are the general responsibilities and program of public service of the Illinois State Geological Survey. Physical data supplied by this state agency serves as an aid to planning groups throughout the state. Examples of surveys and services carried on by the agency are: (1) survey of economic resources for the Division of Industrial Planning and Development; (2) survey of water resources planning for the Water Resources Committee of the State Chamber of Commerce; (3) served as member of the Technical Advisory Committee on Water Supply and Waste disposal of the Northeastern Illinois Planning Commission; (4) investigated the geologic problems of Northeastern Illinois as part of a water resource study; and (5) conducted a geologic survey for the Board of Economic Development for a state-wide water resources development plan. The future program of the agency will include more integrated geologic studies that will be of assistance for pollution and contamination control, mineral resource development, design of civil works, and land use. These studies go beyond the immediate problem of water resources to the broad field of basic data for regional planning for economic growth. (Starr-Chicago)
W70-00515

UNITED STATES RIVER TREATIES,
For primary bibliographic entry see Field 06E.
W70-00518

THE TERRITORIAL SEA: A QUEST FOR UNIFORMITY,
For primary bibliographic entry see Field 06E.
W70-00519

THE GREAT POND ORDINANCE--COLLECTIVISM IN NORTHERN NEW ENGLAND,
For primary bibliographic entry see Field 06E.
W70-00522

WATER AND WATERCOURSES--RIPARIAN RIGHTS AS APPLIED TO ARTIFICIAL WATERCOURSES,
For primary bibliographic entry see Field 06E.
W70-00523

CONCURRENT JURISDICTION OF A NAVIGABLE BOUNDARY RIVER.
For primary bibliographic entry see Field 06E.
W70-00524

CIVIL LAW PROPERTY--BEDS OF NAVIGABLE WATERS--SUSCEPTIBILITY OF PRIVATE OWNERSHIP.
For primary bibliographic entry see Field 06E.
W70-00526

IOWA WATER LAW: PROBLEMS TO BE CONSIDERED.
For primary bibliographic entry see Field 06E.
W70-00573

QUALITY IN THE CONTROL OF QUANTITY,
California Univ., Berkeley.
For primary bibliographic entry see Field 06G.
W70-00606

RESOURCE QUALITY AND VALUE OF THE LANDSCAPE,
California Univ., Berkeley.
For primary bibliographic entry see Field 06G.
W70-00607

PROBLEMS OF QUALITY AND QUANTITY IN THE MANAGEMENT OF THE LIVING RESOURCES OF THE SEA,
California Univ., San Diego, La Jolla.
For primary bibliographic entry see Field 06G.
W70-00608

THE QUEST FOR QUALITY IN THE ADMINISTRATION OF RESOURCES,
California Univ., Berkeley.
For primary bibliographic entry see Field 06G.
W70-00610

ON SOME MEANINGS OF 'PLANNING',
California Univ., Berkeley.
For primary bibliographic entry see Field 06G.
W70-00611

COMMENT ON THE PLACE OF WATER RESOURCES PLANNING IN ECONOMIC REGIONAL DEVELOPMENT,
Northwestern Univ., Evanston, Ill.
Robert S. Gemmell.
IN The Fresh Water of New York State: Its Conservation and Use, p 182-183, Wm C Brown Book Co, Dubuque, Iowa, 1967. 2 p. Edited by Lauren B. Hitchcock.

Descriptors: *Planning, Economics, Investment, Water resources development, Census, Water quality, Costs, Prices.
Identifiers: *Economic regional development, Water resource planner, Regional planner, Regional development, Social overhead capital, Water quantity.

Water resources planning plays a diffuse role in economic regional development. It is an essential activity, but its contribution is difficult to ascertain. Consequently, the water resources planner must be prepared to serve as advisor to the regional planner. He must assist in the formulation of the water resources portion of the regional development plan. Such a plan, however, is not static; it is evolutionary. As such, the water resources planner must devise numerous schemes for development of this resource and make known to the regional planner the consequences of implementing these schemes. He must prepare a 'catalog of merchandise' so that the regional planner can shop intellectually and purchase those items which best serve the region's economic and social interests. (Loeb-Rutgers)
W70-00614

EFFICIENCY IN GOVERNMENT SPENDING,
Netherlands School of Economics, Rotterdam.
W. Dress.
Public Finance, Vol XXIII, No 1-2, p 1-47, 1967.

Descriptors: *Government, *Budgeting, *Cost-benefit analysis, Taxes, Prices, Costs, Economic analysis, Values, Economic efficiency, Income, Debt, Conservation, Water resources, Financing, Roads, Education, Agriculture
Identifiers: *Public finance, *Spending, Stabilization program, Budgeting, Collective goods, Income transfers.

This study is concerned with the evaluation of the area of public finance. The ideas governing expenditures, the concept of maximizing a social welfare function and the distribution of income are among the topics discussed. Program budgeting is studied and a significant section is devoted to the role of cost-benefit analysis. The section on collective goods discusses the economics of such areas as defense, police protection, conservation, basic research and foreign aid. The chapter on infrastructure contains a section on water resources relating the state of the art of public finance in that area as well as some of the problems. Income transfers are discussed, the concept of elasticity in the area is explained along with the different types and aims of income transfers. In addition to the section directly devoted to water resources, much of the theory of public finance applied to other areas has application in the public water resource area. (Murphy-Rutgers)
W70-00615

RESEARCH GOALS AND PROGRESS TOWARD THEM,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-00619

ANTICIPATING THE NATIONS NEED FOR ECONOMIC KNOWLEDGE,
National Bureau of Economic Research, New York.
Geoffrey H. Moore.
46th Annual Report, National Bureau of Economic Research, p 1-5, June 1966. 5 p.

Descriptors: *Economics, *Forecasting, Government, Measurement, Employment, Prices, Costs, Profits, Data collections.
Identifiers: *National Bureau, *Economic research, *Research policies, Business cycles, Borrowing.

The article seeks to explain the role of economic research in anticipating the nation's needs for basic information. The significant results of economic research are usually realized in the distant future. The author gives some examples of research which proved very useful a considerable time after its completion. The author tells of Thorp's work on business cycles as a prime example and briefly describes four recently published works that are likely to find important application in the years to come. The research policies of the National Bureau are described as an example of ones which provide the necessary soundness as well as flexibility. The large amount of economic research necessary for present and future water resource problems necessitates the understanding of the purposes and justification of research. This article provides a general argument for extending and supporting this research. (Murphy-Rutgers)
W70-00620

GOVERNMENT RESEARCH AND DEVELOPMENT PROGRAMS,
Princeton Univ., N.J. Dept. of Economics.
Frederick M. Scherer.
Measuring Benefits of Government Investments, Washington, The Brookings Institution, p 12-70, 1965. 59 p, 5 fig, 3 tab, 48 ref. Edited by Dorfman, R.

Descriptors: *Research and development, *Federal government, *Economic analysis, Investment, Risks, Benefits, Costs, Decision making, Income, Budgeting.
Identifiers: *Tradeoffs, *Cost-effectiveness, Market, Substitution, Marginal returns, Utility function, Time-cost.

This article deals with two distinctive aspects of government research and development programs. The first aspect concerns itself with the intangible benefits of such programs which are difficult to assess in a monetary common denominator. The second aspect concerns research and development investment decisions which encompass 'tradeoffs' that have few close parallels in non-research activities. This article examines the problem of measuring research and development program benefits in a nonmarket environment, emphasizing the role of benefit estimates in time-cost tradeoff decisions. A convex development possibility function is assumed in an attempt to gain better information on the benefits and costs of research and development programs since such information would lead to improved resource allocation decisions. Due to the importance of benefit evaluation in the water resource field, this article is of interest to the water researcher. (Murphy-Rutgers)
W70-00621

MEASURING BENEFITS OF GOVERNMENT INVESTMENTS.
Harvard Univ., Cambridge, Mass.

Washington, DC, The Brookings Institution, 1965. 429 p. Edited by R Dorfman.

Descriptors: *Government, *Investments, *Resource allocation, Accidents, Cost-benefit analysis, Capital, Costs, Decision-making, Federal government, Public health, Income, Marginal cost, Pricing, Measurement, Recreation, Research and development, Taxes, Transportation, Urban renewal, Water resources, Welfare economics, Government supports.
Identifiers: *Subsidies, *Development programs, Public expenditures, Land Water Conservation Bill, Time-cost tradeoff.

This book is a compilation of papers and discussions designed to explore the problems of appraising the benefits that are likely to accrue from proposed public investment projects. The areas covered include research and development expenditures, outdoor recreation projects, education programs, federal aviation, highways, urban renewal and public health programs. The general feeling was that benefits of such government investment projects could be appraised objectively and even quantitatively. This was based on skillful application of benefit-cost analysis, which had been developed in the past thirty years mostly for application to water resources development. Both because of this factor and due to the fact that other methods of benefit evaluation pertinent to water resources are presented, this book is of special use to the water resource researcher. (See also W70-00623). (Murphy-Rutgers)
W70-00622

OUTDOOR RECREATION,
Institute of Public Administration, Washington, D.C.; and National Planning Association, Washington, D.C.
Ruth P. Mack, and Sumner Myers.
Measuring Benefits of Government Investments, Washington, The Brookings Institution, p 71-116, 1965. 46 p, 2 tab, 28 ref. Edited by R Dorfman.

Descriptors: *Recreation, Cost-benefit analysis, *Measurement, *Forecasting, Mathematical studies, Market, Government, Conservation, Resources, Shoreline, Prices, Swimming, Lakes, Public lands, Investment, Input-output analysis.
Identifiers: *Merit-weighted user days, *Utility, *Dollar measure, Beach clubs.

This article explores concepts and methods for providing a useful measure of the benefit derived from government expenditure on outdoor recreation. Such benefits are measured in terms of merit-weighted user-days of outdoor recreation. Two ways are discussed of attempting to arrive at an estimate of current benefit to be derived from a given amount of current expenditures on outdoor recreation. The dollar value approach is limited for intra-program analysis, since market prices are least suitable where most needed and the price/benefit relationship is uneven for different types of recreation and people. This approach becomes more valuable if user-prices are charged for public recreation facilities. The approach of a measure in terms of a merit-weighted service unit seems to improve intra-program decisions, since it can utilize hard information and can accommodate value judgments about noncommensurables. Inter-program comparisons are also aided by this approach. Due to the important relation between water resources and outdoor recreation, this article is of interest to water resource researchers concerned with benefit measures for water oriented recreation projects. (See also W70-00622). (Murphy-Rutgers)
W70-00623

REGIONAL DIFFERENCES IN THE IMPACT OF IRRIGATION ON FARM OUTPUT,
Illinois Univ., Urbana; and International Rice Research Inst., Los Banos (Philippines).
For primary bibliographic entry see Field 03F.
W70-00624

OPERATIONAL PROCEDURES FOR EVALUATING FLOOD PROTECTION BENEFITS,
Department of Agriculture, Washington, D.C.; and North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 06F.
W70-00625

IRRIGATION WATER USE IN THE UTAH VALLEY, UTAH,
Central Michigan Univ., Mount Pleasant.
For primary bibliographic entry see Field 03F.
W70-00627

THREE ESSAYS ON THE STATE OF ECONOMIC SCIENCE,
Tjalling C. Koopmans.
New York, McGraw-Hill Book Company, Inc, 1957. 231 p.

Descriptors: *Economics, *Resource allocation, *Mathematical models, *Mathematical studies, Measurement, Statistical methods, Statistical models, Profit, Supply, Prices, Equilibrium, Income, Economic efficiency, Linear programming, Input-output analysis, Time, Capital interest, Methodology, Psychological aspects, Model studies, Return to scale, Sites, Decision making, Risks, Preferences.
Identifiers: *Economic knowledge, *Price system, Economic theory, Empirical investigations, Mathematical concepts, Statistical concepts, Mathematical economics.

This volume is composed of three essays which are concerned with questions of substance, of method, and of tools in the area of economics. The author offers an explanation of some recent developments in economic theory, comments on the character and the basis of economic knowledge, and offers his ideas about the possible direction of future work in theory and in empirical investigations. The essays concern the parallel development of economic theory and economic observation and measurement in order to increase man's understanding and society's control of economic conditions. More particularly, they concern the development and use of mathematical and statistical concepts for these purposes. The first essay attempts to communicate the logical content and some of the underlying reasoning of certain recent developments in mathematical economics. The second essay urges a clearer separation, in the construction of economic knowledge, between reasoning and recognition of facts. It recommends the postulational method as the principal instrument of separation. The essay further explores various directions in which the postulates of economic theory could be modified and refined in order to recognize more aspects of reality. The third essay considers the interaction between tools of analysis and the choice of problems in economics. As such, this book presents numerous points of interest to the general economist including those individuals involved in theoretical and empirical treatment of water resources. (See also W70-00631 and W70-00632). (Loeb-Rutgers)
W70-00630

ALLOCATION OF RESOURCES AND THE PRICE SYSTEM,
Yale Univ., New Haven, Conn.
Tjalling C. Koopmans.
IN Three Essays on the State of Economic Science, McGraw-Hill Book Co, Inc, New York, p 1-126, 1957. 126 p, 41 fig.

Descriptors: *Economics, *Resource allocation, Profit, Supply, Prices, Equilibrium, Income, Economic efficiency, Linear programming, Input-output analysis, Time, Capital, Interest.
Identifiers: *Price system, *Point sets, *Linear space, *Convexity, Linear function, Consumption, Decentralization, Incentives, Convex sets, Free entry, Horizon.

Recently, new applications of mathematics to the field of economics have provided the economist with additional tools for economic analysis. The essay argues that the common logical structure of received economic theories of diverse origin can be developed with the help of more fundamental mathematical tools. In Section 1 of this essay the author explains the concept of a linear space and its use in describing any commodity bundle by a point in such a space. Since a restraint on choice is then suitably described by a set of points, the author reviews a few concepts and theorems of point sets in linear spaces that are useful in economic theory and illustrate their application. The first concept to be discussed, that of summation of sets, provides a tool for translating restraints on individual choices into limitations on their aggregate effects, and for showing that profit maximization at given uniform prices can under suitable conditions be decentralized. The second concept, that of convexity of a point set, allows the author to formulate conditions with regard to technology and preferences that ensure the existence of a price system which sustains decentralized optimizing production and consumption decisions. These concepts are then used in combination for the description of competitive equilibrium and the analysis of its optimality properties for the further study of productive efficiency under constant returns to scale and its relation to the price system and for the study of allocation of resources over time. This type of analysis is useful in the water area due to the increased use of mathematical models for water planning decisions. (See also W70-00630). (Loeb-Rutgers)
W70-00631

THE INTERACTION OF TOOLS AND PROBLEMS IN ECONOMICS,
Yale Univ., New Haven, Conn.
Tjalling C. Koopmans.
IN Three Essays on the State of Economic Science, McGraw-Hill Book Co, Inc, New York, p 169-220, 1957. 52 p.

Descriptors: *Economics, Mathematical studies.

Identifiers: Problems, Economic dynamics, Computing techniques, Management science, Statistical inference, Economic behavior, Sample survey, Tool developments, Research.

When we set about defining a field of scientific inquiry, such as economics, we identify a class of phenomena to be studied. For instance, in defining descriptive economics, we may say that we study the satisfaction of wants in human society. The particular formulation of such a definition is of no great importance and other forms may be more accurate or more informative. However, we observe that the definition specifies only the problems to be studied and not the tools of observation and analysis to be applied to these problems. In principle, tools have a servants status. The best choice of tools depends on the problem area selected and on the extent to which at least partial answers have been found. The tools that should be developed for future use depend on the precise nature of the problems that seem most likely to be demanding or promising further answer. If we look with a historian's interest at the development of a science, however, we find that tools also have a life of their own. They may even come to dominate an entire period or school of thought. The availability of certain tools may lead to an awareness of problems that can be solved with their help. Tools may thus become a guide to research. In any case changes in tools and changes in emphasis on various problems go together and interact. The essay examines four recent and current tool developments and seeks to perceive some of their implications for future research. The essay is relevant to the water area in respect to the development of tools such as mathematical and statistical techniques which are currently applied to the water area in an extensive manner. (See also W70-00630). (Loeb-Rutgers)
W70-00632

WATER-RESOURCES ENGINEERING,
For primary bibliographic entry see Field 06D.
W70-00634

THE CONDITIONS FOR ECONOMIC GROWTH OF THE ARID LANDS,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
M. M. Kelso.
International Conference on Arid Lands in a Changing World, June 3-13, 1969, University of Arizona, Tucson, 1969. 22 p, 3 ref.

Descriptors: *Arid lands, *Natural resources, *Economics, *Agriculture, Mineral industries, Irrigation, Elasticity of demand, Mexico, Income, Population.
Identifiers: *Economic growth, *Per capita income, *Western U.S., Australia, South Africa, Amenity resources.

The author discusses opportunities for and constraints upon self-generating economic growth in arid regions of the world. Economic growth is defined in per capita income terms. Arid and semiarid regions of the world are all hinterlands to some industrial market-economy heartland and they are all largely dependent on natural resource-based primary production for their economic growth. Those areas will be favored which (1) contain a diversity of natural resources permitting advantage of a wider range of demands; (2) are close linearly, economically, and culturally to their industrial heartlands; (3) are free of strong barriers imposed by nation-state boundaries; and (4) are not burdened already with over-population or cultures poorly adapted to functioning smoothly in larger market economics. Most of the arid areas of the world face severe restraints to attainment of internal self-generating growth. Agriculture in these arid regions requires irrigation to produce those crops which are good growth stimulators. Frequently a water supply is lacking or will require large capital to develop or may already be 'locked up' by the indigenous population. Amenity resources emerge rather late as bases for economic growth owing to their cultural distance at early stages of development. (Crouse-Arizona)
W70-00693

STRUCTURE OF THE ARIZONA ECONOMY: OUTPUT INTERRELATIONSHIPS AND THEIR EFFECTS ON WATER AND LABOR REQUIREMENTS. PART I. THE INPUT-OUTPUT MODEL AND ITS INTERPRETATION,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
Anilkumar G. Tijoriwala, William E. Martin, and Leonard G. Bower.
Arizona Agricultural Experiment Station, Tucson, Technical Bulletin 180, Nov 1968. 33 p, 18 tab.

Descriptors: *Input-output analysis, *Economics, *Arizona, *Water requirements, *Water values, Industrial water, Economic prediction, Arid lands, Agriculture, Model studies, Labor supply.

The 'Leontief' system of input-output accounts is used to develop quantitative estimated of interrelationships of the complete economy of Arizona. Part I of this report describes the model in some detail. With supplementary data, output requirements from each industry can be translated into requirements for primary resource needs such as water - an important consideration in arid Arizona. Primary resources are basic factors of production, the total quantity of which may not be increased in response to additional requirements. Water intake coefficients are developed which represent the quantity of water required by each sector to produce $1,000 of output. An increase in feed grains and food production would take 42 acre feet of additional water input per $1,000 of output, compared with .21 acre feet required per $1,000 increase in output in the utilities sector. Value added per acre foot of water intake is $13.52 for the food and feed grains sector, but is $140,331.18 for the fabricated metals and machinery sector. These and other coefficients developed in the analysis are discussed in terms of their implications for economic growth in Arizona. (Crouse-Arizona)
W70-00697

THE WATER RESOURCES OF CHILE; AN ECONOMIC METHOD FOR ANALYZING A KEY RESOURCE IN A NATION'S DEVELOPMENT,
Resources for the Future, Inc., Washington, D.C.
Nathaniel Wollman.
Baltimore, Johns Hopkin's Press, 1968. 279 p, 4 fig, 1 map, 102 tabs, 31 ref, 3 append.

Descriptors: *Water resources development, *Future planning (Projected), *Water utilization, Competing users, Crop production, Mineral industry, Reasonable use, Water conservation, Distribution patterns, Irrigation practices, Water demand, Water management (Applied), Water quality, Water pollution, Administrative agencies, Appraisals, Decision making, Arid lands, Estimating, Geographical regions, Desalination, Long-term planning, Regional analysis, Water law, Economic feasibility, Human population.
Identifiers: *Chile.

The main objective of this book was to workout a methodology for careful planning and programming of a national water development program, within the framework of general economic and social planning, adaptable to any country. Subjects treated are geography, the projection model, a general survey of agriculture, use of water for irrigation, experience with government irrigation projects, projection of agricultural water use, mining and electric power, manufacturing uses of water, municipal water use, waste treatment and dilution, total water requirements, the cost of water, the effect of water shortage, the question of water quality, and effects of variations on the system. Each subject or problem is treated as a part of the entire social economic system and the expected results of certain programs are predicted. Lack of adequate data for rational decision making is discussed and areas of greatest need are indicated. (Sherbrooke-Arizona)
W70-00699

WATER RESOURCES PLANNING IN AUSTRALIA,
Adelaide Univ. (Australia). Faculty of Architecture and Town Planning.
F. D. Wallace Van Zyl.
Tijdschrift voor Economische en Sociale Geographie Vol 58, No 6, p 306-315, Nov-Dec 1967. 5 fig, 11 ref.

Descriptors: *Multi-purpose projects, *Regional analysis, Recreation, Precipitation (Atmospheric), Erosion control, Irrigation systems, Resource development.
Identifiers: *Australia, *Snowy mountains, Ord River, Regional planning.

Most of Australia's great inland area is arid, and even in the far north where rainfall is relatively high it is concentrated during the monsoon season, with water in short supply during much of the remaining year. For the most part the area in which precipitation exceeds evaporation is limited to a narrow belt of 50-150 miles in width along the coasts. The struggle between urban-industrial and agricultural users has begun. Much of the continent's vast soil and mineral resources remains undeveloped for the lack of water. Water resource development in Australia has been characterized by a lack of integration. Power and water development has been correlated with local agricultural planning as exemplified by the Snowy Mountains Scheme, but seldom with mineral, industrial or national agricultural development. Future water projects should be undertaken only in light of overall national resource planning including adequate economic analysis. In some cases planning should be on an international regional basis since much of northern Australia lies closer to Indonesia and Southeast Asia than to the heavily developed areas of southern Australia. (Crouse-Arizona)
W70-00704

OPTIMUM INESTMENT IN STRUCTURAL FLOOD CONTROL,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Jour Hydr Div, Am Soc Civ Engrs, Paper 6238, HY 6, Vol 94, p 1507-1515, Nov 1968.

Descriptors: *Flood control, *Flood plain zoning, *Optimization, Cost benefit analysis, Economic evaluation, Floods.
Identifiers: *Economic site advantage, *Project-induced economic growth, Project induced damages.

National flood damages have been increasing, despite extensive construction programs, due largely to economic encroachments on the flood plain. This situation calls for a reconsideration of flood control economics. Much of this encroachment occurs as a result of the areas being protected by flood control projects, which results in project-induced economic growth. The flood damages resulting to project-induced growth are negative benefits; but there is also an economic site advantage due to the development in these particular locations. When analysis takes these aspects into consideration a higher degree of protection will be found marginally justified; and partial protection will be shown to be much less advantageous. Basin-wide reservoir systems inherently involve extensive partial flood protection, due partly to the extension of effects downstream and partly to the continual economic development in flood plain areas lower than those to which adequate protection is afforded. Therefore, some way must be found to control project-induced growth downstream, as an adjunct of reservoir systems. This could be done by general reservation of floodways downstream of flood control reservoirs.
W70-00729

ECONOMIC CONSIDERATIONS RELATIVE TO WATER QUALITY,
For primary bibliographic entry see Field 05G.
W70-00730

URBAN DESIGN STUDY OF THE HONOLULU WATERFRONT.

Oahu Development Conference, Oct 1968. 40 p, 39 fig, 4 photo, 18 ref.

Descriptors: *Urban renewal, Design criteria, Recreation demand, Recreation facilities, Aesthetics, Harbors, Inland waterways, Tourism, Hawaii.
Identifiers: Honolulu, Oahu.

The purpose of the study is to analyze conflicting demands on the Honolulu waterfront. A seven-mile section of the waterfront was selected for study. Proposals for development include: (1) trebling the present capacity of the Honolulu International Airport by 1985; (2) enlarging the water sports facilities in Keehi Lagoon; (3) developing and enlarging Sand Island as an industrial park for port-related industry, marine repair facilities, an airport fuel storage depot, and a sewage plant; (4) developing an Inter-Island Ferry Terminal related to the downtown transportation network; (5) linking Chinatown, Downtown and the Civic Center with the waterfront; (6) extending Fort Armstrong peninsula to include a Food Distribution Center, University of Hawaii Oceanographic Center and a new location for the U.S. Bureau of Commercial Fisheries; (7) developing Kewalo Basin to accommodate more shops and restaurants to meet growing demands related to tourism; (8) developing Magic Island to include additional public facilities; (9) rebuilding Waikiki beaches to provide new public facilities and accessways; (10) planning for coping with traffic congestion in Waikiki; and (11) hotel and apartment development close to Diamond Head. The three fundamental development policies of this study are aimed at developing Waikiki primarily for the visitor and casual resident. These policies are: (1) adequate transportation facilities to and from the airport and pleasant pedestrian access-ways to the beaches and other recreational facilities; (2) preserving the aesthetic value of Diamond Head and the Ala Wai; and (3) reducing unrelated automobile traffic. (Starr-Chicago)
W70-00750

COORDINATION OF URBAN PLANNING AND FLOOD PLAIN DEVELOPMENT,
Eugene O. Johnson.
IN Flood Plain Management, Iowa's Experience, ed Merwin D. Dougal (Iowa State University Press, 1969), p 103-111. 1 fig, 11 ref.

Descriptors: *Water management (Applied), *Flood control, *City planning, Land use, Flood plain zoning, Non-structural alternatives.
Identifiers: *Duck Creek, Davenport, Iowa, Flood plain management.

This article discusses efforts to combine management and controlled flood plain use in a 'middle of the road' approach to solving problems of flood plain occupancy in Davenport, Iowa. A brief history of flood control measures and plans since 1918 is given. By 1965 two very different approaches were proposed as solutions to the problem. The Corps of Engineers proposed leaving the entire 100 year flood area in open space use; the second approach was creation of a pilot channel and improved floodway. Both proposals had drawbacks and met with public opposition. A compromise program was finally evolved through coordination of the Corps of Engineers, the INRC, and the City of Davenport. It called for confining a design flood within the area that would normally be inundated by a flood of 10 year frequency. Land fill elevations were established that would place any future structures above the control elevations. Regulations were to be enforced through flood plain zoning of two types: (1) a channel district which would be confined to open space uses, and (2) a flood plain district in which construction would be allowed in accordance with zoning and elevations ordinances. Administration, enforcement, and control would rest with the local governing body. This program, although it was legally sound and seemed to meet all requirements of the various agencies involved, failed to gain public acceptance. In conclusion, without coordination, development of adequate solutions for flood plain management and flood control is difficult to achieve. Also, it is necessary to familiarize political representatives in city government with the overall program in order to gain public support. (Marriott-Chicago)
W70-00751

THE INTERACTION OF URBAN REDEVELOPMENT AND FLOOD PLAIN MANAGEMENT IN WATERLOO, IOWA,
John R. Sheaffer.
IN Flood Plain Management, Iowa's Experience, ed by Merwin D. Dougal (Iowa State University Press, 1969), p 123-135. 3 fig, 11 ref.

Descriptors: *Water management, *Flood control, *Multiple-purpose projects, Urban renewal, Land reclamation, Recreation, Area Redevelopment, Economic efficiency, Benefits.
Identifiers: *Waterloo, Iowa, *Flood plain management.

The interrelation of flood problems and other urban deficiencies is illustrated by an analysis of Waterloo, Iowa; a city of 75,000 that is bisected by the Cedar River. Associated with Waterloo's flood problems were acute land and water resource management problems which were of great economic importance to the area. A traditional single-purpose construction solution was proposed by the Corps of Engineers but was found to be unacceptable because although it would control the 100-year flood water it would do nothing to mitigate the other problems also present. Instead, the community sought a complex metropolitan-area water management strategy. A decision was made to join two major but separate national domestic efforts--flood control and urban renewal--into an integrated urban program. A flood control project was devised that would emphasize preservation and reclamation of the esthetic and environmental qualities of the Cedar River, would eradicate slums and blight, create new public and private uses of land, and restore the diagonal belt of deterioration which bisected Waterloo. The complex multipupose plan called for modifications of the Corps plan which are discussed in some detail. Benefits of the modified program include lowering of costs, improved environmental quality, stimulation of new economic growth, and a shorter time to complete the project. (Marriott-Chicago)
W70-00752

THE ILLINOIS STATE PLANNING PROGRAM,
Illinois State Board of Economic Development.
Guy Kelnhofer.
Water Resources Planning in Illinois, Illinois Board of Economic Development, 1964. p 39.

Descriptors: *Water resources planning, *Water resources development, Coordination, Future planning.

The statewide planning program of Illinois' official planning agency, the Board of Economic Development, is described. Beginning with studies of the population and economic prospects of the State and its regions, an inventory and analysis of the State's public works expenditures, and a preparation of a plan for the development and management of the State's water resources, future work programs will be undertaken. These will include statewide planning for outdoor recreation, transportation, land use, natural resources, and capital budgeting. The objectives of the board's statewide planning program are: (1) provision of an advance warning of impending changes in the economy of the State and in the distribution of its population; (2) preparation of plans which can serve as a basis for coordinating public and private development activities in an area; (3) definition of the State's interests in certain important areas; (4) maximization of returns on State investments in public facilities; and (5) organization of a system of data collection. Through development of a planning program which meets these objectives, the Board can provide State officials with the information necessary to implement courses of action to meet expected future problems. (Starr-Chicago)
W70-00753

ILLINOIS PLANNING STUDIES AND COORDINATING ACTIVITIES,
Illinois State Board of Economic Development.
Gene H. Graves.
Water Resources Planning in Illinois, Illinois Board of Economic Development, 1964. p 29-30.

Descriptors: *Water resources planning, *Water resources development, Coordination, Future planning, Research and development, Water allocation, Population, Economic prediction.

The record of Illinois state agencies in carrying out broad water resources responsibilities is discussed. The role of the Board of Economic Development as a coordinating and planning agency supplementing separate agency programs is described. Specific water resources functions were assigned to the board; some derived from groups which had been abolished and others were added in order to expand the State's role in water resources. The board constitutes a formal organization for coordinating efforts and for facilitating cooperation between agencies. Another important function of the board is to participate in and review federal programs or projects. Planning is seen as a critical aspect of the board's functions. The placing of this function with the board facilitates solving the effects of population growth and of increasing industrial water use. A series of planning studies were undertaken by the board to describe the nature and distribution of water in Illinois and to describe water uses. These studies are aimed at providing a dependable adequate supply for all users. Discussed in these studies are all the levels of activity, federal, state, and local, public and private which are involved in water development and management and in providing water services. (Starr-Chicago)
W70-00754

RESEARCH PERSPECTIVE FOR SOCIOLOGICAL PROBLEMS INVOLVING WATER RESOURCES,
Utah State Univ., Logan.
Melvin L. Cotner.
IN Proceedings of the Workshop for Sociological Aspects of Water Resources Research, Held at Utah State University, Logan, Utah, April 18-19, 1968, Report No 1, Social Science Institute Series, p 47-62. 10 ref.

Descriptors: *Research and development, *Social values, Water resources development, Economic impact, Institutions, History, Planning, Political aspects, Political constraints, Institutional constraints, Legal aspects, Financing, Cost sharing.
Identifiers: *Sociology, Economic growth, Information diffusion.

The paper focuses on problems that are economic in nature but require sociological research to be dealt with adequatly. The first section discusses the relationship of resources to economic growth. Science and technology can increase the quantity and quality of resources, and so affect economic growth. To deal with the dynamic development and use of water resources created by science, we must provide an appropriate institutional system which incorporated a complete overview of resource use, trends, supplies, development possibilities, appraisals of demand, etc. The history of water resources planning is summarized. The second section discusses cultural and political influences on water resources and economic growth. Traditional and agrarian values within the social structure; sectional interests; and a complex set of laws, administrative rules, and political gerrymandering retard economic growth and present questions for the social scientist. Section 3 discusses five research topics: (1) cultural barriers; (2) non-economic mo-

tives; (3) organizational arrangements; (4) financial arrangements; and (5) legal arrangements. The section recommends indepth studies of the ordering of values that influence individuals to adopt watershed practices. It recommends research on: the information-diffusion process; alternate planning organizations; the most effective cost-sharing procedures; and term lease arrangements between a State and a private user. Related questions are suggested. (Gossen-Chicago)
W70-00755

WATER FOR PEOPLE,
Utah State Univ., Logan.
Albert H. Stevenson.
IN Proceedings of the Workshop for Sociological Aspects of Water Resources Research, Held at Utah State University, Logan, Utah, April 18-19, 1968, Report No 1, Social Institute Series, p 89-94.

Descriptors: *Water shortage, *Public health, Water resources development, Water quality control, Political aspects.

The report discusses two topics: (1) community water supply, and (2) the relationship of health to water resource development and water quality control. According to the report, 'Historically, urban water supply needs have had profound effects upon the political system in major cities. The 'have' community may force the annexation of adjacent 'have not' communities. Limited foresight in planning and development of community water systems has curtailed the growth potential of major cities even in the 1960's.' Two solutions for current urban water shortage problems are: a reduction in system leakage, and a reduction in per capita water consumption. The latter is discussed from a viewpoint of water as a commodity and implies a change in traditional water use patterns from non-metered residential use to a metered system. Either solution must be communicated to the public in non-technical terms. The relationship between health and water quality control is discussed in terms of swimming. Health officials should outline predictable results from swimming in waters of different qualities using, for example, enterococcus as measurement indicator. Mosquito problems should be considered in development of the hot irrigated western valley regions. (Gossen-Chicago)
W70-00756

POTENTIAL SOCIOLOGICAL RESEARCH IN WATER RESOURCES DEVELOPMENT,
James D. Sears.
IN Proceedings of the Workshop for Sociological Aspects of Water Resources Research, Held at Utah State University, Logan, Utah, April 18-19, 1968, Report No 1, Social Science Institute Series, p 95-103.

Descriptors: *Planning, Economic efficiency, Preservation, Attitudes.
Identifiers: *Army Corps of Engineers, Regional development, Susquehanna River Basin, Information diffusion.

The Army Corps of Engineers is undergoing a change in emphasis from planning with a single objective--economic efficiency--to using systematic analysis of alternative objectives and programs. The Corps has initiated a modified planning process with three objectives: regional economic development and environmental quality, as well as economic efficiency. Planning for the Susquehanna Basin will consider these objectives in separate plans. The Economic Efficiency Plan would satisfy needs that are economically justified by national benefits. The plan may include large main reservoirs but preclude preservation of scenery. Mine drainage control would probably be minimum. The Regional Development Plan would satisfy needs that are economically justified by a mix of uses, regional, and national benefits. Such a plan may include a greater degree of resource development and a recreation complex to stimulate regional economic development. The Environmental Quality Plan would preserve scenic rivers and other high value environmental quality features. More costly development alternatives and mine drainage control would be included. The needs to discover public attitudes and to disseminate information are discussed. The operation of the Graduate Fellowship Program, which employs selected graduate students from all fields to carry out research and analysis, is described. (Gossen-Chicago)
W70-00757

SOCIAL PROBLEMS NEEDING SOLUTIONS, STATE AGENCIES,
Idaho Univ., Moscow. Water Resources Research Inst.
Calvin C. Warnick.
IN Proceedings of the Workshop for Sociological Aspects of Water Resources Research, Held at Utah State University, Logan, Utah, April 18-19, 1968, Report No 1, Social Science Institute Series, p 115-118. 1 ref.

Descriptors: *Attitudes, Planning, Idaho, Scenery, Social values.
Identifiers: *Interest groups, Sociology, Water replacements.

The central problem of planning is that of establishing objectives. Conflicting social interests present a major difficulty in defining goals. Specific conflicting interests in Idaho include: whether scenic rivers should be preserved in a national wild rivers system, and whether a system of water replacements should be adopted. Changing social interests must also be considered in the planning process. In Idaho, reclamationists presently form a powerful interest group, and concern for clean waters is increasing. Reasons for changing interests require study. The lecture concludes that research in social science should involve studies on: (1) goals of water resource planning that will enhance the welfare of people locally, by states, and nationally; (2) the establishment of population dispersion to areas where water is readily available; (3) the quality improvement of waters and acceptance of necessary action programs; (4) social values in preserving certain scenic streams; (5) attitudes of special interest groups and their influence on possible water resource developments; (6) social attitude problems in connection with lands around water developments, along lake fronts, and along stream banks; and (7) ways of changing attitudes toward water exchanges and special replacement schemes. (Gossen-Chicago)
W70-00758

A FRESH APPROACH TO WATER LAW,
Abel Wolman.
Am Water Work Assn J, Vol 50, No 10, p 1279-1284, Oct 1958. 6 p, 3 ref.

Descriptors: *Water policy, *Water resources development, *Competing uses, *Water demand, Water allocation (Policy), Administration, Water utilization, Water requirements, Water resources, Water shortage, Legislation, Budgeting, Administrative agencies.

The recent concern over water policy and water use has resulted from several factors. First, population growth and the development of new devices requiring water have increased water use. Second, cheaper sources of water have already been preempted and development of new sources has been more costly. Third, this increased demand for water in recent years has occurred concurrently with a dry cycle of weather. The factors have caused a resurgence of competitive demands for water. These demands should be met with a rational state water program, not hastily conceived legislation. The essential elements of a sound state water program are: (1) an estimation of the magnitude of available water resources; (2) a continuing accumulation of information on the availability of the resource in specific areas; (3) an accounting process for the quality of these resources; (4) an estimate of the expected use; (5) a program of developing water resources; and (6) administrative agencies with sufficient budgets to resolve a development program. These administrative agencies should be permanent, flexible, and actively responsive to changing trends. (Gabrielson-Florida)
W70-00768

THE UNITED NATIONS AND MARINE RESOURCES,
David S. Browning.
Wm and Mary L Rev, Vol 10, No 3, p 690-704, Spring 1969. 15 p, 35 ref.

Descriptors: *International law, *International Hydrological Decade, *International waters, *United Nations, Federal government, Standards, Conferences, International commissions, Continental shelf, Marine geology, Oceans, Commercial fishing, Data collections, Treaties, Jurisdiction, Ownership of beds, Political aspects, Marine fisheries, Exploitation, Exploration, Natural resources, Legal aspects, Resource development.
Identifiers: *Territorial waters, Ocean floor.

Because of growing international interest in the exploitation of marine resources, the United Nations has become involved in discussions concerning the nature of these resources and the proper legal environment for their exploitation. By international convention the continental shelf, wherein a coastal nation may exercise its jurisdiction, is defined as extending to submarine areas under two hundred meters or less of water, or as far beyond that point as resources can be exploited. The uncertainty of this definition, as well as national claims to exclusive fishing zones up to two hundred miles, reveals a need for new international standards. With technology rapidly increasing, many of the smaller members of the United Nations fear that the oceans will become subject to a colonial-type grab by the powerful nations, resulting in an inequitable division of the sea's resources. The first manifestation of this concern was when Malta proposed a declaration and treaty concerning the reservation exclusively for peaceful purposes of the ocean floor and the use of its resources in the interests of mankind. The outgrowth of this and other recent proposals and discussions is that the U.N. has declared an International Decade of Ocean Exploration to begin in 1970. (Schram-Florida)
W70-00783

INTERSTATE COOPERATION IN RIVER BASIN DEVELOPMENT,
Lynton K. Caldwell.
Iowa L Rev, Vol 32, No 2, p 232-243, Jan 1947. 12 p, 27 ref.

Descriptors: *Interstate, *Federal jurisdiction, *State jurisdiction, *Water resources development, River basin development, History, Legislation, Conservation, Interstate commissions, Interstate compacts, Interstate rivers, Navigable waters, Judicial decisions, Navigation, Inland water ways, Pollution abatement, Irrigation, Industrial water, Administrative decisions, Community development, Federal-state water rights conflicts, Social needs, Political aspects.
Identifiers: *Interstate cooperation.

Although jurisdiction over the navigable waters of the nation has been assumed by the federal government under the doctrine of implied powers, the extent of this federal authority remains indeterminate. The states have always exercised certain powers over rivers and lakes within their boundaries and Congress, through approval of interstate compacts, has recognized this interest. After early efforts at interstate cooperation, the federal government began in 1879 to exercise and expand its jurisdiction over navigable waters. Growing population and the expansion of machine technology intensified the pressure on all national resources between 1910 and 1940. Governmental action was needed to improve navigation, to protect water for human consumption, to make water available for

industry, to irrigate land, to abate pollution, to drain land, to prevent floods, to conserve fisheries, and to provide for recreational uses. The federal government, able to cut across state lines, possessing greater fiscal and technical facilities, and unhampered by constitutional prohibitions, was able to move more rapidly than the states. More recently, however, states are demonstrating that the cooperative solution of regional problems can be successfully undertaken. Thus, new forms of inter-governmental organization, involving interstate-federal cooperation, are emerging to meet current needs. (Schram-Florida)
W70-00784

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST OF MUNICIPAL SEWAGE TREATMENT,
Illinois Dept. of Registration and Education, Urbana.
For primary bibliographic entry see Field 05D.
W70-00493

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS: A SELECTED ANNOTATED BIBLIOGRAPHY,
Tennessee Valley Authority, Washington, D.C.
For primary bibliographic entry see Field 06B.
W70-00495

SOME OBSERVATIONS ON ECONOMIC EVALUATION STUDIES,
Oregon State Univ., Corvallis.
Emory Castle.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 68-71, Mar 1964.

Descriptors: *Benefit-cost ratio, Competing uses, Public benefits, Monetary benefits, Input-output analysis.

Non-government economists' writings have generally reached conclusions that would lead to a more conservative public investment policy in water resource development. Senate Document No. 97 is seen as favoring public as opposed to private investment; natural resource investment over other kinds of public investment; and long-term over short-term public investment. Specific provisions of the document are reviewed. Secondary benefits are usually seen as not being relevant to decision-making in the private sector of the economy so long as primary and secondary firms are independent units. In the Senate document, however, secondary benefits are defined precisely and are provided for by inclusion in the benefit-cost ratio. The author contends that secondary benefits will increase the benefit-cost ratio, while, at the same time, there are no existing means of measuring these secondary benefits or predicting their lasting effects. The pressure for public investment in water resources is such that the agencies have no alternative other than to include in their measurements of many questionable items. Economic evaluation studies must be undertaken with inadequate and imperfect tools and procedures. Suggestions are given to improve existing technique: (1) benefit-cost ratio should be recognized as only one criterion of the worth of a project; (2) benefit-cost analysis should be used to measure economic efficiency considerations primarily and not too many other objectives of public investment; (3) academic economists should be aware of the problems of economists in government agencies and yet avoid being trapped by the procedures and rules of these agencies. (Starr-Chicago)
W70-00499

SOME PROBLEMS IN EVALUATION OF WATER RESOURCES,
Washington Univ., Seattle.
James A. Crutchfield.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, p 72-74, Mar 1964.

Descriptors: Technology, Market value, Discount rate, Tangible benefits, Intangible costs, Estimated benefits.

While benefit-cost frameworks have produced significant improvement in the development and application of criteria for public investment in water resources, it is not a perfect instrument. Three areas for improvement are cited: (1) improvement of existing valuation techniques; (2) extension of these techniques to intangibles; and (3) a careful assessment of some basic assumptions underlying current measures of social benefits and social costs. Some problems of evaluation are (1) the discount rate is seen as being too low and, therefore, public investment may be slanted too much in the direction of long-lived, large scale projects; (2) the impact of technological change is another complication of the long-term investment. Short-term projects could more easily embody technological change; (3) the soundness of present methods of measuring benefits is questionable; (4) little empirical evidence that on redistribution effects of major investment programs in the water resources field; (5) present assignment of responsibility for federal water programs does not encourage consideration of all alternatives. Two general policy recommendations are given: (1) need for an independent audit of planning activities related to water; and (2) more effective use of market prices should be made to facilitate valuation procedures and administrative procedures. (Starr-Chicago)
W70-00500

AREAS OF DEFICIENCY AND RESEARCH NEEDS IN WATER RESOURCE PLANNING,
For primary bibliographic entry see Field 06B.
W70-00501

A MEASURE OF WATER RECREATION BENEFITS: THE MERAMEC BASIN EXAMPLE,
For primary bibliographic entry see Field 06B.
W70-00507

CREDIT AND COLLECTION POLICIES AT EUGENE, OREGON,
Eugene Water and Electric Board, Oreg.
J. E. Brown.
Journal of American Water Works Association Vol 61, No 5, p 234-236, May 1969. 3 p, 1 fig.

Descriptors: *Credit, *Economics, *Water utilities, Instrumentation, Computers, Public health.
Identifiers: *Collection, *Bad debt losses, Accounts receivable, Credit history, Service suspension, Collection agencies, Unemployment, Public welfare.

This article surveys the credit and collection policies of water utilities of the Water and Electric Board of Eugene, Oregon. This is of vital interest since credit is routinely given in the utility business. Economically, this industry works for 'nothing' by selling services at cost; poor credit and collection policies in this industry can easily result in working for less than nothing by selling the product and failing to collect for it. The theory in Eugene attempts to rectify this situation by reducing bad debt losses to the lowest possible level and speed the collection of receivables to free capital for production in other parts of the business. To achieve this, Eugene maintains a complete credit history of all customers, requires deposits, and suspends service for non-payment. These measures have been found necessary due to prosperity which has given false promise of ability to pay, increasing bankruptcies, family migration, unemployment programs, health plans, social security and welfare programs. (Murphy-Rutgers)
W70-00597

CONTROLLING ACCIDENT COMPENSATION COSTS,
San Diego, Calif.
J. F. Gleason.
Journal of American Water Works Association Vol 61, No 5, p 231-233, May 1969. 3 p.

Descriptors: *Accidents, *Costs, *Water works, *Claims, *Legal aspects, *Financing, *Insurance, Compensation, Management, Economics.
Identifiers: *Industrial safety, *Accident prevention, Disability awards, Loss control, Liability, Apportionment.

This article deals with industrial safety, particularly in the area of water works. For this reason, it is of interest to these working in the water resource field, especially the researcher concerned with the economics of safety. Industrial safety reflects the effectiveness of management control over accidents and accident costs, particularly evidenced since the establishment of workmen's compensation laws. Of great concern to water works management is the severity rates and costs of accidents, since these seem to rise, although overall accident rates and costs have declined. Positive loss control actions, as well as increased accident prevention measures, are greatly needed, especially in water works, to control the severity factor. Claims control, legislative persuasion, and adequate financial control are necessary to achieve these ends. (Murphy-Rutgers)
W70-00598

TAXATION AND THE DISPOSITION OF DEPRECIABLE ASSETS,
State Univ. of New York, Buffalo.
Ronald J. Huefner.
The Engineering Economist, Vol 14, No 3, p 141-150, Spring 1969. 10 p, 1 ref.

Descriptors: *Decision making, *Investment, *Taxes, Depreciation Risks.
Identifiers: *Depreciable assets, Internal Revenue Code, Depreciation deductions, Capital gains, Additional depreciation, Income tax, Depreciation method, Sale, Exchange.

The Internal Revenue Code presently provides, under Section 1245 and 1250, for the 'recapture' of depreciation deductions, by taxing certain gains from the sale of depreciable assets at ordinary income rates. Section 1245 covers depreciable assets with the exception of buildings and their structural components. Upon disposition of Section 1245 assets, the gain is taxable at ordinary rates, to the extent of the amount of depreciation claimed since January 1, 1962 and any remainder at capital-gains rates. Section 1250 covers depreciable real property and provides that, upon the early retirement of such assets, the gain will be taxed as ordinary income, to the extent of a portion of any 'additional depreciation' deductions after January 1, 1963. The portion of this additional depreciation which is subject to ordinary income-tax rates is 100 percent less one percentage point for each full month the asset is held over twenty months. The author considers, first, the effect this tax provision should have upon decision-making with respect to several aspects of depreciable assets and secondly, the effect upon investment decisions in general. As such, this should be applicable to decision-making in the water area, in that methods and timing of the replacement of water facilities would be influenced by the present tax policies. (Loeb-Rutgers)
W70-00600

PRODUCTION COST FACTOR IN RATE-MAKING,
Florida Univ., Gainesville, and Northwestern Univ., Evanston, Ill.
J. P. Heaney, and R. S. Gemmell.
Journal of the American Water Works Association, Vol 61, No 2, p 102-106, Feb 1969. 5 p, 2 tab, 10 ref.

Descriptors: *Municipal water supply, *Costs, *Water rates, *Marginal costs, *Variable costs, Water works, Wells, Aeration, Sedimentation, Economics, Ground water, Economies of scale, Electric power.
Identifiers: *Incremental costs, *Water rate differentials, Plant capacity, Institutional constraints, Debt servicing, Replacement costs.

This article analyzes the production cost component of water utility costs and investigates its role in establishing rates. (The cost of producing water is increasingly important for many communities because of growing scarcity and pollution of existing water supply resources.) Short-run and long-run production costs were examined for the Mount Prospect, Illinois water works. The short-run analysis was to define the relationships between variable costs and actual plant output. Variable costs were found relatively constant for this utility. Where significant production cost differentials exist, the utility has a firm basis to establish water rate differentials. The analysis of production costs as the utility changed its scale of plant indicated that current rate-making practices may be inequitable to certain groups of water users if the expansion takes place where long-run incremental costs of production are increasing. Incremental production cost analysis was found useful in providing an analytical approach to the problem of incorporating the production cost component of water utility expansion into the overall assessment levied on new users. (Murphy-Rutgers)
W70-00602

COST OF CAPITAL TO THE SMALL FIRM,
California Univ., Los Angeles.
Eugene V. Brigham, and Keith V. Smith.
The Engineering Economist, Vol 13, No 1, p 1-26, Fall 1967. 26 p, 6 fig, 1 tab, 1 append.

Descriptors: *Costs, *Capital, Taxes, Debt, Marginal costs, Investment, Risks, Growth rates.
Identifiers: *Small firms, *Cost of capital, *Firm size, Investment theory, Marginal cost of capital, Investment decision, Weighted average cost of capital.

The investment theory of the firm contends that management should adjust the level of capital expenditures to the point where the marginal rate of return for investment projects is equal to the marginal cost of capital. While there has been considerable progress in determining appropriate methods for evaluating and ranking potential investments, little has been accomplished toward developing useful measures of the cost of capital to a typical firm. The cost of capital is typically treated as a known parameter when it is used as a discounting factor or as the appropriate cut-off rate. This paper is concerned with the question of how a firm's size affects its cost of capital and, thus, its capital investment. In particular, its purpose is (1) to postulate the marginal cost of capital schedule as a function of firm size, (2) to justify the postulated schedule on the basis of theoretical arguments and existing empirical studies, and (3) to suggest the implication of such a cost schedule to investment decisions made by managers of small firms. As such, this may be useful to the water planner involved with projects where an investment decision must be made as to water treatment facilities and reservoirs that would require capital financing. (Loeb-Rutgers)
W70-00616

ASSET PRICES IN ECONOMIC ANALYSIS,
California Univ., Berkeley.
Samuel B. Chase.
Berkeley, University of California Press, 1963. 153 p.

Descriptors: *Prices, *Economic analysis, Demand, Risks, Marginal cost, Investment, Government, Taxes, Debt, Elasticity of demand.
Identifiers: *Assets, Liquidity, Wealth, Consumption, Flow supplies, Capital markets.

This study is designed to clarify and emphasize the role of assets in economic analysis. It focuses on the asset pricing process and its interrelations with other economic phenomena and it is argued that these interrelations are crucial in the determination of general equilibrium conditions. The first part of the book deals with the nature of the choice people make when they decide between holding assets and consuming and its implications for the determination of asset prices. The second section of the book is concerned with exploring problems such as an alternative treatment of the connection between present and expected prices, trading costs and liquidity and the workings of the asset market. The last two chapters are of particular interest to the water researcher since they deal with the effect of government debt operations and the implications of government financial policies on demand. (Murphy-Rutgers)
W70-00626

THE RELATIONSHIP BETWEEN FLOOD LOSSES AND FLOOD-CONTROL BENEFITS,
Chicago Univ., Ill.
Edward F. Renshaw.
Pages on Flood Problems, Chicago, Chicago University Press, p 21-45, 1961. 1 fig. Edited by Gilbert White.

Descriptors: *Flood damages, *Flood protection, *Flood control, *Benefits, *Costs, *Economics, Flood plains, Optimization, Flooding, Investment, Measurement, Data collection, Taxes land use, Resource allocation, Government supports, River basins, Insurance.
Identifiers: *Flood losses, *Flood loss estimation, *Subsidies, Social costs, Secondary losses.

In the first part of this paper the relationship between flood losses and flood control benefits is discussed within a context of (1) optimal regional development, (2) a case involving social costs, and (3) situations leading to a general over-development of flood-plain land. The author feels that there exists no theoretical justification for assuming a one-to-one correspondence between flood losses and benefits accruing to the community as a whole from flood prevention. In the second part, attention is focused on the measurement of flood losses. It is suggested that a number of traditional categories of losses can be ignored and that physical loss estimates can be improved with greater use of synthetic models. A six point program for improving loss estimates is presented. (Murphy-Rutgers)
W70-00628

COST ALLOCATION IN RELATION TO WESTERN WATER POLICIES,
California Univ., Berkeley.
S. V. Ciracy-Wantrup.
IN Economics and Public Policy in Water Resource Development, Ames, Iowa, Iowa University Press, p 189-208, 1965. 20 p, 14 ref. Edited by S. C. Smith, and E. N. Castle.

Descriptors: *Cost allocation, *Joint costs, *Water resource development, Economic feasibility, Cost repayment, Rates, Multiple-purpose projects, Government, Costs, Benefits, Prices, Government supports, Taxes, Industrial water, Municipal water, Irrigation, Public utilities, Water policy, Construction.
Identifiers: *Yardstick, *Form of contract, Joint product.

This article is concerned with the problem of cost-allocation in the sense of apportioning joint costs of multiple-purpose projects to individual purposes. There has usually been a connection between cost allocation and several issues such as economic feasibility, repayment, rate making, and form of contract. It is to these issues that the author hopes to apply an economic analysis although he acknowledges the problems involved in connecting these issues and cost allocation. An extensive analysis is performed on each of these issues with recommendations as to possible improvements. The article concludes with an examination of the means in which economic analysis of water resources policy can be applied to the political and legal facts of life. Reclamation laws, in particular, are receptive to the principles suggested in the article. (Murphy-Rutgers)
W70-00633

PARAMETRIC ECONOMIC AND ENGINEERING EVALUATION STUDY FOR WATER DESALINATION,
Booz-Allen Applied Research, Inc., Bethesda, Md.
For primary bibliographic entry see Field 03A.
W70-00726

FRONTIER TOWN PROPERTIES, INC V STATE (CONDEMNATION VALUE OF WATER USE).

58 Misc 2d 388, 296 NYS2d 90-111 (NY Ct Cl 1968).

Descriptors: *New York, *Eminent domain, *Condemnation value, *Water utilization, Judicial decisions, Land use, Land appraisal, Land development, State governments, Water rights, Dams, Energy, Powerplants, Impounded waters, Appropriation, Ponds, Rivers, Highways, Condemnation, Relative rights, Legal aspects, Water use.

Claimant brought this action to recover compensation for land appropriated by the state in an eminent domain proceeding. Claimant contended that it also owned the right to use waters from a river located on the land in order to create an amusement park. The deed from claimant's grantor reserved all water rights and riparian rights in the river. Claimant was, however, deeded an existing dam for as long as the impounded waters were not used for power purposes or the generation of electric energy. The state contended that this restriction prohibited claimant from generating energy for any commercial use or development. If such a prohibition did, in fact, exist the value of claimant's use of the appropriated land would be substantially reduced. The court discussed the effect of the language in the deed. The court held that claimant did not have a legal right to use the water for the generation of electrical energy. The court did, however, find that claimant had the right to develop the land area bounding the impounded waters in any manner suitable for the theme park or commercial or recreational purposes, and consequently claimant was entitled to compensation. (Heckerling-Florida)
W70-00805

6D. Water Demand

THE USE OF SUBSIDIES FOR WASTE ABATEMENT,
Clemson Univ., S.C. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W70-00488

EFFLUENT CHARGES,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-00489

EXTERNALITIES AND THE QUALITY OF AIR AND WATER,
Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W70-00490

PUBLIC VS. PRIVATE GOODS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W70-00491

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIEN CE: CHAPTER 1 INTRODUCTION,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W70-00528

SPATIAL BEHAVIOR IN RECREATIONAL BOATING,
Ohio State Univ., Columbus; Texas A and M Univ., College Station; and Wright State Univ., Fairborn, Ohio.
B. Lentnek, C. S. Van Doren, and J. R. Trail.
Journal of Leisure Research Vol 1, No 2, p 103-124, Spring 1969. 22 p, 6 fig.

Descriptors: *Recreation, *Water resources, *Boating, *Spatial distribution, Lakes, Land management, Economies, Time, Demand.
Identifiers: *Spatial behavior, *Nonmarket-priced phenomenon, *Geography of demand, *Consumer surplus, Water skiing, Sailing, Canoeing.

This article examines some spatial aspects of recreational boating in Ohio. The study evolved as a result of another study of nationwide outdoor recreation resources which ranked water as a primary recreation resource. Boating was concluded to be a popular water-based recreation activity, especially in the North Central region. The Ohio study encompassed varied watercraft uses, such as cruising, fishing, water skiing, sailing, and canoeing. These are the five distinct groupings by activity. The authors also found three spatially-oriented groups characterized by different propensities to travel; sailors having the least propensity and fishermen the greatest propensity to travel. These findings imply the existence of a definite spatial structure to the activity specializations of the fifteen surveyed lakes. Hopefully these findings can contribute to a conceptualization of an analytical system, based on empirical evidence which aids in understanding recreational behavior. This article is of special interest to water resource researchers since it deals quite specifically with the role water resources plan in recreation. (Murphy-Rutgers)
W70-00601

PLANT SIZING FOR A SEASONAL PRODUCT DEMAND USING A LINEAR PROGRAMMING MODEL,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 06A.
W70-00604

OPTIMAL WATER ALLOCATION: THE NORTH PLATTE RIVER,
North Carolina State Univ., Raleigh; and Chase Manhattan Bank, New York.
G. S. Tolley, and V. S. Hastings.
Quarterly Journal of Economics, Vol LXXIV, No 2, p 279-295, May 1960. 17 p, 3 fig, 1 tab.

Descriptors: *Water resource allocation, *Optimization, Rivers, Irrigation, Investment, Water demand, Water supply, Economic efficiency, Costs, Water rights, Canals, Leakage, Water storage, Value, Planning, Water uses.
Identifiers: *Priority system.

This study seeks to determine the optimal distribution of water, taking as given the major investments that have been made in dams, irrigation canals, and other water facilities. The first part of the paper discusses the methodology for optimally allocating water supplies and shows solutions for problem situations. The problems studied are those of allocating water between power and irrigation, taking account of delivery losses along a canal and the effects of water rights. These results are used in the second part of the paper which examines water allocation in view of the interrelations of the river system as a whole. The areas above and below Lake McConaughy on the North Platte River were treated by this analysis and important malallocations were found to be associated with the unequal effects of water rights in water short years. (Murphy-Rutgers)
W70-00629

ALLOCATION OF RESOURCES AND THE PRICE SYSTEM,
Yale Univ., New Haven, Conn.
For primary bibliographic entry see Field 06B.
W70-00631

WATER-RESOURCES ENGINEERING,
Ray K. Linsley, and Joseph B. Franzini.
New York, McGraw-Hill Book Co, 1964. 654 p.

Descriptors: *Water resources, *Engineering, Planning, Water management, Investment, Water resources development, Groundwater, Runoff, Probability, Droughts, Water law, Reservoirs, Dams, Spillways, Gates, Outlet works, Open channels, Pressure conduits, Hydraulic machinery, Economics, Irrigation, Navigation, Water supply, Hydroelectric power, Drainage, Sewage, Disposal, Water quality control, Flood control.
Identifiers: Storage routing, Flood frequency, Flood formulas, Rainfall frequency, Engineering economy, River navigation.

With the world population doubling every four decades, the water resources of the world are becoming one of its most important assets. Water is essential for human consumption and sanitation, for the production of industrial goods, and for the production of food and fiber. Water is an important means of transport in many parts of the world and a significant factor in recreation. Even a valuable resource can be a hazard and excessive floods cause substantial damage and loss of life throughout the world. Water is unequally distributed about the earth, and its availability at any place varies with time. Finally, in his use of this resource, man pollutes much of the available fresh water and degrades it so that it is unfit for many uses. Skilled planning and management are necessary to achieve the level of efficiency in water use which will be required in the future. Investments in water-resources development are influenced by economic, social, and political considerations as well as the basic engineering facts. The first five chapters of this volume present the subject of hydrology. Chapter 6 discusses the legal aspects of water use. Chapters 7 through 12 discusses the physical works utilized in almost all types of water-resources projects. Chapter 13 reviews the important principles of engineering economy basic to water-management. Chapters 14 through 20 discuss the principal water uses in more detail and the final chapter summarizes the planning procedures for single and multipurpose projects. (Loeg-Rutgers)
W70-00634

STRUCTURE OF THE ARIZONA ECONOMY: OUTPUT INTERRELATIONSHIPS AND THEIR EFFECTS ON WATER AND LABOR REQUIREMENTS. PART I. THE INPUT-OUTPUT MODEL AND ITS INTERPRETATION,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.
W70-00697

WATER FOR PEOPLE,
Utah State Univ., Logan.
For primary bibliographic entry see Field 06B.
W70-00756

LAWS OF FLORIDA GOVERNING WATER USE,
Frank E. Maloney.
Am Water Works Ass'n J, Vol 47, No 5, p 440-446, May 1955. 7 p, 21 ref.

Descriptors: *Florida, *Water allocation (Policy), *Water demand, *Reasonable use, Water supply, Water law, Irrigation water, Water control, Water shortage, Irrigation, Legal aspects, Industrial water, Water distribution (Applied), Percolation, Groundwater movement, Riparian rights, Surface-groundwater relationships, Planning, Saline water intrusion, Natural flow doctrine.

Post and potential increases in irrigational and industrial demands for water in Florida, combined with increasing problems of salt-water intrusion and domestic uses, evidence a need for a re-evaluation of Florida's water laws. Most of Florida's water law is based upon case rulings. The water use rule as to watercourses is the reasonable use rule subject to a similar right of use by all riparian owners. Thus the question is whether diversion for irrigation or industrial use would be reasonable. The two faults of this rule are its indefiniteness and its failure to provide for diversion for use on non-riparian land. The law of reasonable use has been applied to ground water following a definite channel. Percolating waters are governed by the doctrine of correlative use or the doctrine of reasonable use. None of the above standards are clearly established by case law or sufficient to give a satisfactory criteria to control water use. A possible answer is to replace the case law with a comprehensive water code. The need for water planning becomes more apparent every day and the governor's citizen committee on water resources a constructive first step. (Darragh-Florida)
W70-00769

6E. Water Law and Institutions

UNDERSTANDING THE WATER QUALITY CONTROVERSY IN MINNESOTA,
Minnesota Univ., St. Paul. Agriculture Extension Service.
For primary bibliographic entry see Field 05G.
W70-00430

POWERS AND DUTIES OF THE DIRECTOR OF THE DIVISION OF FISH AND GAME AND OF GAME WARDENS.

Ind Ann Stat secs 11-1301 thru 11-1309 (1956).

Descriptors: *Indiana, *Fish conservation, *Wildlife conservation, *Regulation, Legislation, Legal aspects, Conservation, Reproduction, Fish, Fish reproduction, Frogs, Mussels, Wildlife, Jurisdiction, Administrative agencies, Investigations.
Identifiers: *Penalties (Criminal), Game wardens.

The Director of the Division of Fish and Game of the Department of Conservation enforces the provisions of this act and all laws of the state enacted for the propagation or protection of game, fur-bearing animals, birds, frogs, mussels, or fish. Game wardens assist the Director in carrying out his duties. The Director and the game wardens may arrest any person who is violating or attempting to violate any provision of this act or any other law of the state enacted for the protection of wildlife. The Director and game wardens are authorized to search any vehicle or receptacle in which game may be carried and may enter upon any property for purposes of patrolling or investigating when they have good reason to believe they will secure evidence of the violation of a wildlife conservation law. The Director and his officers may at any time seize and take possession of wildlife illegally possessed and may also seize any devices used for the illegal taking of wildlife; persons found with such wildlife or such devices in their possession are subject to criminal penalties. (Keith-Florida)
W70-00431

LICENSES: NETS, SEINES, AND TRAPS.

Ind Ann Stat secs 11-1434 thru 11-1441 (1956), as amended, (Supp 1968).

Descriptors: *Indiana, *Permits, *Nets, *Fishing, Legislation, Trapping, Jurisdiction, Adjudication procedure, Fish conservation, State jurisdiction, Legal aspects
Identifiers: Penalties (Criminal).

No person may use or set any net, seine, or trap in any waters of this state other than in waters in which such device is licensed. Such nets, seines, or traps may not be lawfully removed to a distance greater than one mile from the waters in which they are licensed for use. Any court having jurisdiction over offenses involving the protection of fish may revoke the license of an offender for up to one year. Any person fishing or trapping while having his license suspended, revoked, or denied shall be guilty of a misdemeanor. (Heckerling-Florida)
W70-00432

REMOVAL OF VEGETATION FROM WATERCOURSES.
For primary bibliographic entry see Field 04A.
W70-00437

LEVEES.
For primary bibliographic entry see Field 04A.
W70-00485

INSTITUTIONAL FACTORS AND THE TEXAS WATER PLAN,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 06B.
W70-00492

PUBLIC WORKS AND CERTAIN PUBLIC AUTHORITIES.

SC Code Ann, secs 59-3, 59-5, 59-6, 59-8, 59-14, 59-15 (1962).

Descriptors: *South Carolina, *Electric power, *Land reclamation, *Navigation, Reforestation, River basin development, Administrative agencies, Condemnation, Land use, Land tenure, Rivers, Navigable rivers, Flood control, Drainage, Hydroelectric power, Projects, Tributaries, Public health, Public benefits, Costs, Cost allocation, Federal Power Act, Construction, Permits, Water utilization, Federal government, Watersheds (Basins).
Identifiers: Public Service Authority.

The Public Service Authority shall have power to develop the Cooper, Santee, and Congaree rivers as instrumentalities of commerce and navigation; to produce, distribute, and sell electric power; to reclaim and drain flooded lands; and to reforest river watersheds in this state. The Authority shall also have the concomitant powers necessary to the exercise of the above-mentioned powers. The Authority shall have the right to acquire, in any legal manner, any lands, waters, easements, franchises, engineering data or estimates prepared for development of the above-mentioned rivers or any other real or personal property necessary in carrying out any of its purposes. The powers of the Public Service Authority shall be exercised by its board of directors, except for those duties imposed by this chapter on the advisory board. The project authorized by this chapter is for the aid of intrastate, interstate, and foreign commerce and navigation and is designed to benefit the health, welfare, and material prosperity of all the people of South Carolina. The Authority may construct the Santee-Cooper hydroelectric and navigation project as outlined by the Federal Power Commission. The two lakes belonging to the state, constructed on the Cooper River, shall be known as Lake Moultrie and Lake Marion. (Carruthers-Florida)
W70-00496

PUBLIC WORKS AND CERTAIN PUBLIC AUTHORITIES.

SC Code Ann, sec 59-3 (1962).

Descriptors: *South Carolina, *Navigation, *Hydroelectric power, *Administrative agencies, Canals, Dam construction, Ditches, Drains, Forestry, Financing, Federal government, Eminent domain, Projects, Legislation.

In addition to the general powers of development of commerce and navigation, reforestation, land reclamation, and production of electric power, the Public Service Authority has the following powers: (1) to have all the attributes and characteristics of a public service corporation; (2) to acquire or dispose of any real or personal property or interest therein; (3) to build, maintain and operate canals, dams, ditches, drains, and roads, and other related structures; (4) to divert waters from the Santee River in order to impound such waters; (5) to build power houses and all other structures customarily used in the manufacture and distribution of hydroelectric power; (6) to transmit and sell such power within and without South Carolina; (7) to reclaim and drain flooded lands; (8) TO REFOREST THE WATERSHEDS OF THE Cooper, Santee, and Congaree rivers; (9) to fix, charge, and collect tolls and other charges for use of the facilities of or services rendered by the Authority; (10) to borrow money and to provide security therefore, including money from the United States Government; (11) to have the power of eminent domain; and (12) to study all undeveloped power sites and navigation projects in the state and to acquire and develop same as the need therefore may arise. Specific regulations govern the details of the issuance of notes, bonds, and other evidences of indebtedness by the Public Service Authority and the giving of appropriate security therefore. (Carruthers-Florida)
W70-00508

OREGON STATE INTEREST AND VIEWPOINT IN RIVER BASIN PLANNING IN THE WILLAMETTE COMPREHENSIVE STUDY,
Oregon State Water Resources Board.
Donel J. Lane.
IN Water Resources Management for the Needs of an Expanding Society, Seminar, University of Washington, Mar 1964. p 6-10.

Descriptors: *Water resources development, State jurisdiction, Federal-state water rights conflict, Oregon, River basin planning.
Identifiers: Willamette River Basin.

The basis for Oregon's interest in water resources planning is a section of a 1909 water code which states that 'all water within the state from all sources of water supply belongs to the public'. In 1939, the legislature created the Willamette Basin Commission which operated until 1955 when a State Water Resources Board was created. The Board was directed to undertake studies of existing water resources, existing and contemplated needs and uses of water for domestic, and industrial purposes, and for pollution abatement. These changes were all given prior to Federal recognition of the merit of conducting such studies. Two serious shortcomings exist for water resource development in Oregon: (1) the State Constitution prevents the lending of the credit of the state for water resource functions; and (2) lack of an agency at the local level with broad fiscal and legal authority to conduct comprehensive planning. (Starr-Chicago)
W70-00509

THE FEDERAL COMPREHENSIVE SURVEYS,
For primary bibliographic entry see Field 06B.
W70-00511

MAKING THE STATE AN EFFECTIVE PARTNER IN WATER DEVELOPMENT,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 06B.
W70-00513

DEVELOPING POSITIVE PUBLIC ATTITUDES FOR WATER RESOURCE DEVELOPMENT,
For primary bibliographic entry see Field 06B.
W70-00514

PUBLIC WORKS AND CERTAIN PUBLIC AUTHORITIES.

SC Code Ann, secs 59-5 thru 59-6 (1962).

Descriptors: *South Carolina, *Administrative agencies, *River Basin Development, *Navigation, Rivers, Flood control, Electric power, Land use, Navigable rivers, Hydroelectric power, Projects, Legislation, Water law, Water utilization, Tributaries.

The Public Service Authority shall have the right to acquire any lands, waters, riparian rights, easements, engineering data, or construction plans prepared for development of the Cooper or Santee rivers. Before such acquisition of any of the above, belonging to any private corporation previously charered to develop the Santee-Cooper project, a full report of the proposed acquisition shall be submitted to the advisory board. After a public hearing and investigation of the proposed acquisition, the advisory board files a written report with the board of directors of the Authority and with the Secretary of State. Details regarding actual purchase and/or condemnation of the proposed acquisition are set forth. The board of directors exercises the powers of the Public Service Authority, except for such duties as are imposed by this chapter upon the advisory board. Upon the appointment and organization of the Public Service Authority, it shall immediately proceed with the development and improvement of the Santee, Cooper, and Congaree rivers and their tributaries upstream to aid commerce and navigation, flood control, and the development of hydroelectric power. The Authority shall have the power to acquire or develop as early as practicable other existing power and navigation projects in the state. (Carruthers-Florida)
W70-00516

KANKAKEE LANDS.
Ind Ann Stat secs 62-605 thru 62-606, 62-611 thru 62-614, 62-617 thru 62-619 (1962).

Descriptors: *Indiana, *Channel improvement, *Drainage, Legislation, Meanders, Boundaries (Property), Rivers, River beds, Beds, Channels, River flow, Swamps, Land reclamation, Land tenure, Ditches, Assessments, Surveys, Limestones, Administrative agencies, Ownership of beds, Taxing.
Identifiers: Kankakee River, Limestone.

Title to all lands included within the meander line of Beaver Lake is confirmed in the grantees holding under a deed of the governor. All unsold lands included within said meander line shall be disposed of according to law. The state auditor may accept trust deeds to Kankakee bed lands for drainage and channel improvement purposes. The governor is to appoint commissioners to supervise the clearing of the channel. The governor is authorized to expend funds derived from the sale of swamp lands bordering the Kankakee River to improve the Kankakee River within the state. The state auditor is ordered to sell all swamp meandered lands along the river in certain named counties. The selling price may include assessments based on the benfits to the land from local drainage ditches. Upon sale, the auditor is to notify the respective local taxing authorities. (McDonough-Florida)
W70-00517

UNITED STATES RIVER TREATIES,
Ludwik A. Teclaff.
Fordham L Rev, Vol 31, No 4, p 697-726, Apr 1963. 30 p, 212 ref.

Descriptors: *United States, *Rivers, *Treaties, *International waters, Mexican Water Treaty, Riparian rights, Legal aspects, Mississippi River, St Lawrence River, Mexico, Federal government, Foreign waters, International law, Alluvium, International Boundary and Water Commission, International commissions, Navigation, Accretion (Legal aspects).

There is little customary international river law in this article. It is the general duty of riparians to conclude agreements concerning the use of an international river. Treaties to this effect date back to the twelfth century. The development of nonconventional international river law in North America is presented. Negotiations and treaties between the United States, France, Spain, Mexico, Great Britain, and Canada are discussed. Agreements concerning United States rivers are all bilateral and secure free navigation for the contracting parties, whereas treaties concerning rivers elsewhere are both multilateral and bilateral. Treaties concerning the Mississippi, United States-Canadian boundary waters, other United States-Canadian waters, and United States-Mexican rivers are discussed from the standpoint of navigation, changing river beds, and uses of water other than for navigation. Treaties of the United States with Mexico and Canada are given special attention as are treaties with nonriparians pertaining to commerce and navigation. The settlement of disputes and the termination of treaties due to war and the problems of succession are discussed. Comparisons with the European fluvial system are given brief attention. The conclusion focuses on the salient features of United States river treaties as well as the negative characteristics of the system. (Moulder-Florida)
W70-00518

THE TERRITORIAL SEA: A QUEST FOR UNIFORMITY,
Oscar Svarlien.
U Fla L Rev, Vol 15, No 3, p 333-351, Fall-Winter 1962. 19 p, 86 ref.

Descriptors: *Law of the sea, *Oceans, *International law, *International waters, International commissions, Fish conservation, Fisheries, Legal aspects, Foreign waters, Treaties, Littoral measurement, Continental shelf, Continental margin, Governments.
Identifiers: *Territorial seas.

While it is generally agreed that a nation is entitled and obliged to exercise sovereignty over its marginal seas, two central problems remain unresolved. They concern both the degree to which, and the area over which, such sovereignty may be exercised. Subject to the rights of foreign vessels to innocent passage and shelter in distress, a nation may exercise the same degree of sovereignty over its marginal waters as it exerts over its land. However, no general agreement among nations exists as to the extent of those waters. Historical precedents regarding extent are examined as are present claims by the United States, some Latin American nations, and Russia. Methods used in measuring territorial waters are discussed with emphasis on the Anglo-Norwegian Fisheries Case, (1951) I.C.J. Rep. 116. Some problems associated with the delimitation of territorial waters are the concern for national security, the traditional principle of freedom of the seas, and the conservation of fishery resources. A survey of the progress made toward delimiting territorial waters examines fishery treaties and attempts at international codification in the area of delimitation. Since the three-mile limit is unpopular with nations, a twelve-mile limit is suggested. (Marsee-Florida)
W70-00519

MUNICIPAL CORPORATIONS-WATERS AND WATERCOURSES-EMINENT DOMAIN-POLLUTION OF WATER AS A 'TAKING' OF PRIVATE PROPERTY,
For primary bibliographic entry see Field 05G.
W70-00520

LIABILITY OF LANDOWNERS FOR POLLUTION OF PERCOLATING WATERS,
For primary bibliographic entry see Field 05G.
W70-00521

THE GREAT POND ORDINANCE--COLLECTIVISM IN NORTHERN NEW ENGLAND,
Lincoln Smith.
Boston U L Rev, Vol 30, No 2, p 178-190, Apr 1950. 13 p, 45 ref.

Descriptors: *Maine, *Massachusetts, *Great ponds, *History, New England, Water law, Judicial decisions, Legislation, Federal-state water rights conflicts, Hydroelectric power, Public rights, Reasonable use, Lakes, Legal aspects, Dam construction, Relative rights, Competing uses, Eminent domain, Usufructuary right.
Identifiers: *Common law, *Public ownership, Public waters.

Basing his article on historical development rather than legal analysis, the author traces the collective theory ordinance in Maine and Massachusetts which places under public ownership all non-tidal ponds of twenty or more acres. Although contrary to both the common law and the traditional opposition to collectivism in Northern New England, this exception stems from the necessity of allowing free fishing and fowling privileges to householders in the colonial days. Extended from the mere right to use these great ponds, judicial interpretation through the years has developed this right into public ownership. The many problems that this ordinance has brought about are the main subjects of the article. Attempts by private corporations to take advantage of this public ownership have been the greatest source of difficulties in recent years. In the future, the author foresees a major conflict between federal and state authorities in relation to control and distribution of hydroelectric power from these great ponds. It is suggested that the peculiar state interest created by the great pond ordinance may give Maine and Massachusetts a bulwark of defense should Washington try to impose its authority contrary to local desire. (Schram-Florida)
W70-00522

WATER AND WATERCOURSES--RIPARIAN RIGHTS AS APPLIED TO ARTIFICIAL WATERCOURSES,
William Kramer.
U Mo Kan City L Rev, Vol 33, No 1, p 143-146, Winter 1965. 4 p, 12 ref.

Descriptors: *Missouri, *Riparian rights, *Artificial watercourses, *Mills, Competing uses, Diversion, Irrigation water, Non-navigable waters, Remedies, Water law, Judicial decisions, Artificial use, Legal aspects, Reasonable use, Relative rights.
Identifiers: *Adverse possession, *Adjacent landowners, Reciprocal rights, Injunction (Mandatory).

Bollinger v Henry, 375 SW2d 161 (Mo 1964), tests the relative rights of adjacent landowners in an artificial watercourse. The watercourse involved was a mill race which had been moved slightly onto the land of an adjacent landowner, with his permission, to straighten out a sharp curve. The adjacent landowner had pumped water from the mill race for five years and, although he could show no actual damages, the owner of the mill race sought injunctive relief from such removal. In refusing to grant this relief, the Missouri Supreme Court ruled that the adjacent landowner had riparian rights in the mill race. The court recognized the general rule that riparian rights do not usually attach to artificial waterways, but applied the exception that where owners of different parcels of land conduct water across both parcels in an artificial channel and do not define their respective interests in the water, their reciprocal rights thereto are to be measured and determined as if they were riparian owners. Reasons for this exception to the general rule are given through a historical case development. The fact that previously this exception applied only to incidents where there had been mutual participation of the landowners involved in the construction of the waterway is discussed, and possible consequences of this new decision are given. (Schram-Florida)
W70-00523

CONCURRENT JURISDICTION OF A NAVIGABLE BOUNDARY RIVER.

Md L Rev, Vol 9, p 268-281, 1948. 14 p, 54 ref.

Descriptors: *Boundary disputes, *Interstate, *Jurisdiction, *Maryland, Judicial decisions, Interstate rivers, State jurisdiction, Interstate compacts, Rivers, Navigable rivers, Boundaries (Property), River beds, Virginia, State governments, Local governments, Legal aspects.
Identifiers: Potomac River, Criminal proceedings.

Questions of concurrent jurisdiction of courts over crimes committed on navigable rivers as between two counties within a given state bordering the river and as between two states whose boundary is the river are raised in Barnes v State, 47 A2d 50 (Md. 1946). The appellant, a Virginia citizen, had been convicted in Maryland for a crime committed on a steamboat on the Potomac River. He attacked the decision alleging lack of jurisdiction in the Maryland county and lack of Maryland jurisdiction to try him. Prince George's County, Maryland, pursuant to Maryland laws giving concurrent jurisdiction to the various counties from, to, or through which a steamboat may travel, convicted the appellant following grand jury indictment. That county had exclusive jurisdiction in Maryland to try the appellant because it was the first county to assume jurisdiction. Virginia, Maryland, and the Congress, by agreement in 1877, had fixed the low water mark on the Virginia shore as the boundary between the states. Maryland therefore had exclusive jurisdiction on the Potomac for criminal offenses. The decision was affirmed on appeal to the Court of Appeals and certiorari was denied by the United States Supreme Court. (McDonough-Florida)
W70-00524

PROPERTY RIGHTS OF RIPARIAN OWNER IN MISSOURI WITH RESPECT TO OBSTRUCTION OF A NATURAL OR ARTIFICIAL WATERCOURSE,
Paul A. Hanna.
Mo L Rev, Vol 18, No 1, p 67-74, Jan 1953. 8 p, 29 ref.

Descriptors: *Missouri, *Riparian rights, *Surface waters, *Obstruction to flow, Judicial decisions, Surface drainage, Surface runoff, Land tenure, Lakes, Artificial watercourses, Natural streams, Damages, Levees, Dams, Natural flow, Legal aspects, Natural streams, Relative rights.
Identifiers: Common enemy doctrine.

In the case of Happy v Kenton, 247 SW 2d 698 (Mo 1952), plaintiff and defendants were both landowners on a natural lake. Defendants constructed a levee on their land across an outlet through which water had previously drained from the lake. Because of the levee, the water level of the lake was raised and the size of the lake increased causing damage to plaintiffs' crops. Plaintiffs contended that defendants had obstructed a natural watercourse. Defendants argued that they had only prevented surface water from flowing across their lands. The principal issue was whether defendants had obstructed a natural watercourse. There was evidence in the case that the outlet had been artificially deepened following the lines of natural drainage and that the drain was a definite channel in which water flowed most of the year. The Missouri Supreme Court held that the drain should be considered as a natural watercourse and affirmed the lower court verdict. Missouri is committed to the doctrine that one may not obstruct a natural watercourse without liability for ensuing damages to others, but that one may otherwise treat surface

waters as a common enemy and obstruct their flow without liability for ensuing damages so long as he does so reasonably and not recklessly or negligently. At least until 1953, the Missouri courts had not definitely decided on the rule to be followed in situations like the instant case. (Heckerling-Florida)
W70-00525

CIVIL LAW PROPERTY--BEDS OF NAVIGABLE WATERS--SUSCEPTIBILITY OF PRIVATE OWNERSHIP.

La L Rev, Vol 15, No 2, p 463-465, Feb 1955. 3 p, 16 ref.

Descriptors: *Louisiana, *Ownership of beds, *Navigable waters, *Public rights, Legislation, Judicial decisions, Land tenure, Patents, Leases, Water law, Beds, Beds under water, Legal aspects.
Identifiers: *Alienation of beds, Statute of limitations, Private ownership.

The title to beds of navigable waters in Louisiana has traditionally been considered to have vested in the state since its admission to the Union in 1812. Such beds are considered by the Civil Code to be publicly owned by the 'whole nation' and not susceptible of private ownership. Further, the Louisiana Constitution prohibits alienation of the beds of navigable waters. California Co v Price, 74 So 2d 1 (La 1954) apparently reverses this traditional view. In that case the plaintiff sought a determination of the ownership of royalty funds from oil wells located under navigable waters on beds leased from a private owner who claimed title based on a state patent. The court in Price held that under Act 62 of 1912 the state was required to annul the patent within 6 years or the title to beds of any navigable waters found upon the conveyed lands would pass to the private owner. Immediately after the decision, Act 727 of 1954 was enacted to overrule the court; it reiterated the public policy against alienation of beds of navigable bodies of water. The 1954 Act further interprets the Act of 1912 as applying only to land susceptible of private ownership. Considering this pronouncement of legislative intent, disputes in this area of law should be closely examined. (Harris-Florida)
W70-00526

WATER LAW AND ADMINISTRATION - THE FLORIDA EXPERIENCE,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 1, p 1-28, 1968. 6 fig, 6 tables. OWRR Project A-001-FLA.

Descriptors: *Florida, *Long-term planning, *Water resources, *Water resources development, Riparian rights, Water law, Navigable waters, Non-navigable waters, Boundaries (Property), Recreation, Docks, Consumptive use, Legislation, Permits, Surface runoff, Federal government, Administrative agencies, State governments, Water management (Applied), Water pollution control, Ownership of beds, Beds under water.

This book represents a detailed examination of Florida Water Law. The introduction sets forth general water facts and quantitative water needs of Florida. The major areas covered in the next eleven chapters are: rights in defined waterbodies--riparian rights; ownership of upland as the source of riparian rights; non-consumptive uses of natural navigable waterbodies; consumptive use of water; common law rules; statutory modification of eastern consumptive use doctrines; rights in disposal of diffused surface water; federal authority and activity affecting Florida's water resources; state administration of water resources; single purpose and multipurpose water management districts; the law and administration of pollution control in Florida; and title to beds under navigable waters. The thirteenth chapter stresses the need for water resources planning and research, both legal and extra-legal. Although Florida has, at present, enough water to meet her needs in the foreseeable future, the authors emphasize the necessity of a master plan for water resources development to insure the maximum beneficial use of this precious natural resource. (See also W70-00528 thru W70-00540). (Wheeler-Florida)
W70-00527

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 1 INTRODUCTION,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 1, p 1-28, 1968. 6 fig, 6 tables.

Descriptors: *Florida, *Statistics, *Water resources, *Water demand, Irrigation, Water supply, Water conservation, Water requirements, Water users, Hydrologic cycle, Surface waters, Precipitation (Atmospheric), Droughts, Evapotranspiration, Floods, Springs, Groundwater, Agriculture, Municipal water, Domestic water, Water quality, Industrial water, Water utilization.

The law has been slow to recognize the interrelationships among the various categories of water. However, legislative and judicial awareness of the hydrologic cycle, specifically Florida's hydrology, is now developing. In attempts to balance the water cycle, the lawmakers not only must study rainfall and drought data, but must also consider the enormous evapotranspiration rate, on which little information is available. Florida's abundant lakes and streams, flat topography, numerous springs, and large groundwater reservoirs further influence the state's particular hydrology. The easily accessible water supply of Florida should exceed the demand in the near future, provided the resource is properly managed. The quantitative needs of all users continue to increase. Ground water is the primary source of municipal supply. Predominant industrial users in Florida are electric power production, the pulp, paper, and chemical industries, citrus processing, and mining. Florida's water resources are also used extensively for navigation and widespread recreational purposes. (See W70-00527). (Wheeler-Florida)
W70-00528

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 2 RIGHTS IN DEFINED WATERBODIES BASIC CONSIDERATIONS,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 2, p 29-65, 1968.

Descriptors: *Florida, *Riparian rights, *Navigable waters, *Federal jurisdiction, Federal government, Legal aspects, State jurisdiction, Water rights, Navigation, Non-navigable waters, Ownership of beds, Riparian waters, Streambeds, Artificial watercourses, Riparian land, Legislation, Regulation, Public rights, Public lands.
Identifiers: Property rights.

Water use rights, both of upland owners and the general public, and the possibility of private ownership of submerged lands are directly affected by a waterbody's classification as either navigable or non-navigable. Riparian rights are generally recognized as property rights attaching to land bordering natural, navigable waterbodies. Florida tests navigability in terms of navigability in fact. The emphasis on navigability in commercial terms may leave recreational interests unprotected. The Florida test differs from federal law in that the former does not include an artificially created present capability. Only a fraction of Florida's lakes were meandered, and the presumption of navigability raised by the federal survey can be rebutted. Although Florida is considered to hold title to beds of navigable waterbodies in trust for its people, public rights in navigable waterbodies have been complicated by state conveyances of many such beds to private interests. Florida's legislation affecting navigability raises interpretational and constitutional problems. The distinction between artificial and natural waterbodies and the effect of the classification on public and private rights is also analyzed. The chapter includes a detailed discussion of a Florida statute which greatly implicates the determination of navigability of non-meandered Florida lakes. (See W70-00527). (Wheeler-Florida)
W70-00529

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 3 OWNERSHIP OF UPLAND AS THE SOURCE OF RIPARIAN RIGHTS,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 3, p 66-97, 1968. 1 fig, 1 table.

Descriptors: *Florida, *Riparian rights, *High water mark, *Riparian land, Severance, Legal aspects, Banks, Boundaries (Property), Water level fluctuations, Tidal waters, Fresh water, Highways, Judicial decisions, Legislation, Meanders.

Determination of whether the owner of a particular tract of land is entitled to riparian rights often poses difficult problems. Especially complex is the question of whether the tract actually abuts on a navigable waterbody. The high water mark first must be located. This procedure is much more complicated for tidal than nontidal waters. The question whether the water mark, once located, constitutes a boundary of the tract is largely a matter of interpretation of the grantor's intention. If the high water mark and a meander line are substantially coincident, the former is generally considered as the boundary. However, whenever the meander line lies substantially away from the waterbody, most jurisdictions, including Florida, treat the meander line as the boundary. Florida is confronted with troublesome decisions concerning ownership of riparian rights in cases involving platted streets which adjoin and parallel waterbodies. The issues that must be decided on a case by case basis are: (1) does the platted street reach to the water's edge; (2) who owns the street; and (3) whether compatible riparian rights are to be allocated between opposing claimants according to their interests. Several cases have tended to indicate that riparian rights may be lost by certain conveyances of riparian land. (See W70-00527). (Wheeler-Florida)
W70-00530

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 4 NON-CONSUMPTIVE USES OF NATURAL NAVIGABLE WATERBODIES,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 4, p 98-139, 1968.

Descriptors: *Florida, *Non-consumptive use, *Riparian rights, *Public rights, Navigable waters, Riparian waters, Riparian land, Streambeds, Fishing, Swimming, Navigation, Recreation, Access routes, Boating, Water sports, Shores, Docks, Landfills, Ownership of beds, High water mark, Low water mark, Beds, Water levels, Water level fluctuations, Lakes, Dams, Regulation.

Generally, riparian owners are considered to have a valuable right of access to a navigable waterbody. However, the right to navigate, of both riparians and the public, is unsettled, and may be superceded by an overriding public interest. Most courts agree that the public has no right to cross private property to reach navigable waters. Florida takes the

minority position by allowing the public the right to walk along the shores of navigable waterbodies. The right of public boating appears to be recognized in all jurisdictions. Riparians' rights to fish usually are not distinguished from the public's, but questions often arise over exclusive rights and regulation. The taking of the riparian right to swim appears to warrant compensation. Riparians appear to have at least a prima facie right to wharf, which may be denied as a result of conflicting interests. Florida does not seem to recognize any riparian right to fill for nonwharfing purposes, in the absence of statutory authority. Courts probably would not recognize a building right on navigable waterbodies based solely on bottomland ownership. Riparian rights of having a lake maintained at its ordinary level and damming watercourses are discussed. (See W70-00527). (Wheeler-Florida)
W70-00531

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 5 CONSUMPTIVE USE OF WATER: COMMON LAW RULES,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 5, p 140-171, 1968. 6 fig, 1 table.

Descriptors: *Florida, *Consumptive use, *Groundwater, *Surface waters, Surface runoff, Riparian rights, Competing uses, Domestic water, Legal aspects, Municipal water, Reasonable use, Remedies, Water utilization, Percolating water, Aquifers, Hydrogeology, Groundwater basins, Hydrologic cycle, Overdraft, Wells, Surface-groundwater relationships, Damages, Water supply, Saline water intrusion, Underground streams.

Groundwater from limestone aquifers is Florida's principal source of water for consumptive use. The basic problems of groundwater management are: (a) interference between wells; (b) overdraft of the waterbearing bed or aquifer; and (c) contamination. Salt-water intrusion is probably Florida's greatest groundwater contamination problem. Groundwater has been traditionally classified into either underground streams or percolating waters. The significance of the distinctions, however, has been reduced since most jurisdictions, including Florida, now begin with the presumption that groundwater is percolating. However, legal rights continue to hinge upon whether the problems of proof as to the existence of an underground stream can be overcome. Generally, the rights governing surface watercourses apply to underground streams, while the rights regarding percolating waters vary according to whether the common law or reasonable use rule is followed. Many courts hold that as long as the use is beneficial and reasonable, the landowner may use percolating water on overlying land even if such use injures adjoining owners. Florida, however, seemingly applies surface water riparian doctrine to percolating waters. Injunction is usually the preferred remedy respecting groundwater interference. General riparian doctrines are applicable to springs and defined surface waterbodies. With the increasing use of surface waters as a source of supply, the trend is to refine the absolute ownership applicable to such waters. (See W70-00527). (Wheeler-Florida)
W70-00532

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 6 STATUTORY MODIFICATIONS OF EASTERN CONSUMPTIVE USE DOCTRINES,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 6, p 172-197, 1968.

Descriptors: *Florida, *Consumptive use, *Permits, *Regulation, Legislation, Legal aspects, Water utilization, Iowa, Surface water, Surface runoff, Artesian wells, Riparian land, Administrative agencies, Groundwater, Competing uses, Domestic water, Prior appropriation.
Identifiers: Model water use act.

The growing realization of the weaknesses of the riparian system has initiated a trend toward water-rights legislation. Regulation of consumptive use involves the constitutional problem of compensation for any taking of a property interest. The legislative scheme in most eastern states has been to implement permit systems, operated by administrative agencies. Generally, these systems have taken one of three forms: (1) overall compulsory systems; (2) permit systems geared to the needs of problem areas; and (3) permissive permit systems. In 1957, Florida provided for a compulsory permit system in critical areas; however, such regulation is limited since it depends upon the creation of water regulatory districts to become operative. However, the experience in the Pinellas County-Hillsborough County area has demonstrated the great difficulty of regulating water users under this statute. Florida's 1957 law also provides for permissive permits for excess water, and has the apparent advantage of allowing diversion beyond riparian land. However, the law's purpose of encouraging the use of excess water has not been effective since no permits have yet been issued. Another Florida statute regulates the use of artesian wells to prohibit waste and contamination of other water supplies. The authors explore the advantages and problems of eastern permit systems. The eastern system is also compared with the western system of prior appropriation. (See W70-00527). (Wheeler-Florida)
W70-00533

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 7 RIGHTS IN DISPOSAL OF DIFFUSED SURFACE WATER,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 7, p 198-220, 1968.

Descriptors: *Florida, *Surface runoff, *Repulsion (Legal aspects), *Remedies, Damages, Lakes, Reasonable use, Alteration of flow, Ponds, Diversion, Flood control, Natural flow doctrine, Obstruction to flow, Natural streams, Floods, Marshes, Surface waters, Swamps, Civil law, Water law, Riparian land, Riparian rights.
Identifiers: Injunctions (Mandatory), Injunctions (Prohibitory), Common enemy doctrine.

'Diffused surface water' is a catch-all phrase which includes all forms of waters which do not fall within the legal classification of lakes, ponds, and natural watercourses. The problems involving diffused surface water usually concern its disposal rather than its use. The three basic doctrines governing the disposal of diffused surface water are: (1) the civil law rule, (2) the common enemy rule, and (3) the reasonable use rule. The civil law rule, in its pure form, provides that no man may interfere with the natural flow of surface waters. The strict common enemy rule, in contrast, recognizes the right of each landowner to deal as he pleases with surface water on his property without regard to the consequences of such use. The reasonable use rule provides that liability for invasion of an interest in the use and enjoyment of one's land by interference with the natural flow of diffused surface waters depends upon whether the action, if intentional, was unreasonable or if unintentional, was negligent, reckless, or ultra-hazardous. Florida appears to follow the civil law rule. The authors include a discussion of the remedies and defenses available to litigants in the area of interference with surface waters. (See W70-00527). (Wheeler-Florida)
W70-00534

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 8 FEDERAL AUTHORITY AND ACTIVITY AFFECTING FLORIDA'S WATER RESOURCES,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 8, p 221-257, 1968. 4 fig.

Descriptors: *Florida, *Federal jurisdiction, *Administration, *Watershed management, Water management (Applied), Administrative agencies, Drainage systems, Flood control, Irrigation, Water conservation, Water resources, Land management, Federal government, Legal aspects, National parks, Recreation, Navigable waters, Navigation, Water allocation (Policy), Regulation, Costs, Water distribution (Applied).

The authority of Congress to regulate waterways is grounded primarily on the commerce clause of the Federal Constitution. Federal authority extends to all waterways which are navigable. 'Navigable waterways' in this context are such waterways as are capable of supporting commerce. The federal definition of navigability covers not only watercourses navigable in their natural state, but also those watercourses capable of being improved to the extent necessary to support navigation. Once a watercourse is determined to be navigable, federal jurisdiction attaches and extends to non-navigable portions of the waterbody which affect navigability. In exercising its authority, the federal government has generally not been held liable for injury caused to private property as a direct result of the regulation and improvement of navigable waters. However, there have been exceptions to this general proposition in connection with improvement of non-navigable waters. The Small Watershed Act provides a broad, multipurpose program which includes land treatment, flood prevention, agricultural water management, and public recreational development. Federal and state costs involved in such programs are discussed. The problem of water distribution and transportation from the Central and Southern Florida Flood Control District to the Everglades National Park is examined from both a physical and legal viewpoint. (See W70-00527). (Wheeler-Florida)
W70-00535

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 9 STATE ADMINISTRATION OF WATER RESOURCES IN FLORIDA,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 9, p 258-286, 1968. 3 fig.

Descriptors: *Florida, *Administrative agencies, *Water resources development, *State governments, Legal aspects, Canals, Channels, Fishing, Fish management, Fisheries, Shores, Shore protection, Beaches, Financing, Grants, Artesian wells, Saline water intrusion, Geology, Beds, Ownership of beds, Federal government, Water pollution, Administration, Planning.

State administration of water resources in Florida is primarily the responsibility of four agencies: (1) the Trustees of the Internal Improvement Fund (management of submerged lands); (2) the Air and Water Pollution Control Commission; (3) the State Board of Conservation; and (4) the Game and Fresh Water Fish Commission. The State Board of Conservation has a multitude of functions and controls the bulk of water resources administrative decisions in the state. The various divisions which comprise the Board of Conservation include Survey and Management, Salt Water Fisheries, Geology, Water Resources and Conservation, Beaches and Shores, and Waterways Development (currently coordinating construction of the Cross-Florida Barge Canal). The structures, problems, powers, and duties of each of these divisions are

lly examined. The board also has the responsibili- of coordinating and setting priorities for roposed projects of all state and local agencies. To ffect such evaluation and coordination, an annual onference is scheduled at which all proposed pro- cts for water resources development are resented and evaluated. This approach enables e board to present a unified program of water sources development to the various congres- onal committees to reduce harmful competition r federal funds. (See W70-00527). (Wheeler-lorida)
70-00536

/ATER LAW AND ADMINISTRATION--THE LORIDA EXPERIENCE: CHAPTER 10 SIN- LE PURPOSE AND MULTIPURPOSE WATER ANAGEMENT DISTRICTS,
lorida Univ., Gainesville. Water Resources esearch Center.
Maloney, S. Plager, and F. Baldwin.
niv of Florida Press, Gainesville, ch 10, p 287-16, 1968. 3 fig.

escriptors: *Florida, *Administrative agencies, Water management (Applied), *Drainage dis- icts, Water resources development, State govern- ents, Legal aspects, Fish management, Financing, rants, Saline water intrusion, Federal govern- ent, Legislation, Governments, Watersheds (Di- des), Wildlife management, Irrigation systems, lood control, Navigation, Recreation, Water con- rvation, Wildlife conservation, Groundwater.

istorically, single purpose water management dis- icts were created in Florida to drain excess water om the land. Other single purpose districts in lorida include water supply districts, aquaduct stricts, and mosquito control districts. Most early rainage districts were created by special acts by e legislature in 1913. The circuit courts were em- owered to create drainage districts when peti- oned by the State Board of Drainage Commis- oners or by a majority of the landowners in a ven area. The Board of Supervisors of each of ese districts was given the power to construct all anner of works, to acquire needed land, and to ondemn land for rights-of-way. The individual ounties were also empowered to create drainage stricts under separate legislation. These single urpose districts are criticized because they usually e created along political lines rather than accord- g to natural watershed boundaries and deal only ith drainage, which is but one aspect of water anagement. Two multipurpose water manage- ent districts have been created in Florida. The entral and Southern Florida Flood Control Dis- ict has powers over flood control, water conserva- on, prevention of salt-water intrusion, improve- ent of navigation, and development of recrea- onal facilities, including the preservation of fish nd wildlife. In addition to possessing these powers the Central and Southern District, the Southwest lorida Water Management District regulates roundwater through a water regulatory district reated under the 1957 Florida Water Resources aw. (See W70-00527). (Wheeler-Florida)
70-00537

/ATER LAW AND ADMINISTRATION--THE LORIDA EXPERIENCE: CHAPTER 11 THE AW AND ADMINISTRATION OF POLLUTION ONTROL IN FLORIDA,
lorida Univ., Gainesville. Water Resources esearch Center.
Maloney, S. Plager, and F. Baldwin.
niv of Florida Press, Gainesville, ch 11, p 317-45, 1968.

escriptors: *Florida, *Administrative agencies, Water pollution, *Pollution abatement, State overnments, Legal aspects, Financing, Grants, ederal government, Legislation, Domestic wastes, ndustrial wastes, Standards, Damages, Reasonable se, Remedies, Riparian rights, Public health, Per- its, Agricultural chemicals, Jurisdiction, Ad- inistrative decisions.

Identifiers: Statute of limitations, Laches, Injunctions (Mandatory), Injunction (Prohibitory).

Florida's main pollution problems are domestic and industrial wastes, state authorization of pollution, and agricultural chemicals. The common law remedies have proven inadequate to control pollution. Riparian owners are hampered by the uncertainty of determination of reasonable use. Although the preventive relief by injunction is preferred over a damage action, equitable jurisdiction is more difficult to secure. Florida's tendency toward restricting permanent damage suits creates the likelihood that successive suits must be brought. Furthermore, the defenses of the statute of limitations, prescription, and laches may deny relief altogether. Due to the weaknesses of the remedies and the realization that courts lack the ability to formulate comprehensive programs, Florida utilizes primarily the administrative process for pollution control. In 1967, Florida completely revamped its pollution control program with passage of the Air and Water Pollution Control Act. This legislation placed primary jurisdiction over pollution control in the new Florida Air and Water Pollution Control Commission. The advantages of a specialized agency were augmented by providing the commission extensive powers. Permits may be required for the construction of disposal facilities, and provisions for stiff civil sanctions should overcome the weaknesses of reluctance of invoking criminal sanctions. The chief problem the new commission faces is financing, and if this and other elements of support are not secure, federal intervention appears inevitable. (See W70-00527). (Wheeler-Florida)
W70-00538

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 12 TITLE TO BEDS UNDER NAVIGABLE WATERS,
Florida Univ., Gainesville. Water Resources Research Center.
F. Maloney, S. Plager, and F. Baldwin.
Univ of Florida Press, Gainesville, ch 12, p 346-405, 1968. 1 fig.

Descriptors: *Florida, *Ownership of beds, *Navigable waters, *Legislation, Beds, Beds under water, Boundaries (Property), High water mark, Low water mark, Riparian rights, Seashores, Civil law, Legal aspects, Lakes, Rivers, Oceans, Bays, Bulkhead line, Landfills, Judicial decisions, Accretion (Legal aspects), Channels, Federal government, State governments, Grants, Meanders.

Florida law relative to ownership of beds under navigable waters requires lengthy explanation, and, even then, defies any real degree of certainty. In general, the beds of navigable waterbodies are held by the state in trust for the people. However, most of the beds of navigable waterbodies have been alienated to private interests by either the Spanish, federal, or state governments; lakes which were not meandered by original government surveyors were presumed non-navigable. However, because of the hazards and other difficulties involved, only a fraction of Florida's lakes were meandered. Therefore, the beds of most of the navigable lakes were sold due to the erroneous presumption of non-navigability. Furthermore, the law is complicated by various uncoordinated legislation which purported to divest the state of title to certain submerged lands. The Riparian Act of 1856, the Butler Bill and the Bulkhead Act and its amendments are analyzed. The Bulkhead Act of 1957 as amended provides for the establishment of bulkhead lines and sets up rules for the sale of tidal lands and the filling of submerged lands. The legal problems relative to title to land formations constantly being altered by accretion, reliction, and avulsion are also discussed. In conclusion, the authors recognize the need for formulation of new rules to protect public rights and to correct past infringements of these rights. (See W70-00527). (Wheeler-Florida)
W70-00539

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE: CHAPTER 13 A LOOK TO THE FUTURE,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 04A.
W70-00540

CIVIL LAW PROPERTY--ALLUVION DISTINGUISHING LAKES FROM RIVERS AND STREAMS,
For primary bibliographic entry see Field 04D.
W70-00541

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
For primary bibliographic entry see Field 05G.
W70-00542

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
For primary bibliographic entry see Field 05G.
W70-00543

DEVELOPING STANDARDS FOR THE PROTECTION OF GROUND WATER,
For primary bibliographic entry see Field 05G.
W70-00544

EMINENT DOMAIN--NAVIGATIONAL SERVITUDE--EFFECT ON EVALUATION OF PORT SITE PROPERTY,
Kenneth L. Keene.
Land and Water L Rev, Vol 4, No 1, p 200-208, 1969. 9 p, 47 ref.

Descriptors: *United States, *Eminent domain, *Compensation, *Riparian rights, Judicial decisions, Damages, Navigation, Construction, Dams, Rivers, Streams, Condemnation, Condemnation value, Evaluation, Easements.
Identifiers: Navigational servitude.

The case of United States v Rands, 88 S Ct 265 (1967), illustrates the extent to which the navigation servitude doctrine may be applied. In 1963, the United States condemned Rands' property for a river development project and did not compensate him for the value of his land as a potential port site. The United States Supreme Court upheld the ruling saying that to compensate this would be to allow additional value representing a private right in what is obviously the public domain. An examination of the relationship between the fifth amendment, eminent domain, the commerce clause, and the navigation servitude doctrine shown that generally the federal government need not compensate private riparian owners for damages resulting from condemnation proceedings concerning the flow of waters. The refusal to compensate is based upon two arguments: (1) no private property right is being taken, only a public right; (2) the government is exercising its paramount navigational power to which riparian rights have always been subject. There is a need for a change in this policy for two reasons: (1) the public should pay for that which benefits the public; (2) riparian owners are reluctant to develop their land for fear of condemnation. (Darragh-Florida)
W70-00545

INTERFERENCE WITH THE PUBLIC RIGHT OF NAVIGATION AND THE RIPARIAN OWNER'S CLAIM OF PRIVILEGE,
Sheldon J. Plager.
Mo L Rev, Vol 33, No 4, p 608-635, Fall 1968. 28 p, 116 ref.

Descriptors: *Navigation, *Riparian rights, *Public rights, *Water policy, Legislation, Judicial decisions, Damages, Access routes, Bodies of water, Navigable waters, Riparian land, Federal government, State governments, Bridge construction,

Public benefits, Structures, Upstream, High water mark, Rivers, Bridges, Legal aspects.
Identifiers: Improvements, Nuisance (Public), Nuisance (Private).

Entering and leaving a navigable body of water usually involves the use of adjacent upland. The courts may hol ' such crossing to be a trespass or it may feel that tl.e riparian has not been injured. In cases where the government makes improvements which materially impair the riparian owner's access to the waterbody, the courts attempt to strike a balance. This area has been highly litigated. As regards the right to navigate, the riparian owner has at least the same rights as any member of the general public. The public has a protected right to navigate except when the federal or state governments require improvement of any waterway for the general good. When the navigation of a stream is impaired or cut off, whether or not the riparian may recover compensation for the loss of his navigation right depends on the type of damage he sustained. If he suffered special damages he might recover. In certain cases the state legislatures expressly authorized structures which impaired navigation, and whether the riparian was damaged was decided by the courts. However, if the structure was expressly authorized by Congress, the federal courts could not recognize any riparian right. Whether structures may be built in a navigable stream is a matter of government policy. (Heckerling-Florida)
W70-00546

OWNERSHIP OF BEDS: POWER TO CONVEY WHEN STATE HAS TITLE.

Minn L Rev, Vol 32, p 484-495, 1948. 12 p, 61 ref.

Descriptors: *Beds under water, *Navigable waters, *State governments, *Ownership of beds, Judicial decisions, Federal government, Easements, Legal aspects, Riparian land, Land tenure, Minnesota, Beds.
Identifiers: Common law.

This note analyzes the views of American courts on the problem of determining the nature and extent of the ownership of the beds of navigable waters. Under the English Common Law, tide lands were prima facie owned by the sovereign while the beds of fresh waters were owned by the riparian landowners. This view was adopted by some American courts. Other states have adopted a different view. Mostly as a result of Supreme Court decisions, it is now settled law that each of the states formed out of the public domain, on admission to the Union, took the title to the beds of all public waters except those which had previously been alienated by the federal government. The courts of some states formed out of the public domain have held ownership of beds under navigable waters to be in the riparian landowners, but have reserved a public right of passage protected by an easement. Questions of ownership of navigable water beds have generally been resolved in favor of the state, but the question of what the state may do with these beds has as yet not uniformly been answered by the courts of the various jurisdictions. The majority seems to favor inalienability of such lands. (Heckerling-Florida)
W70-00547

REAL PROPERTY--EASEMENTS--CONSTRUCTION OF INSTRUMENT GRANTING RIGHT OF FLOWAGE,
For primary bibliographic entry see Field 04A.
W70-00548

FEDERAL ENCROACHMENT ON STATE WATER RIGHTS,
Clarence A. Davis.
ABA Section of Mineral and Natural Resources Law (1959 Proceedings), p 80-92, 1959. 13 p, 14 ref.

Descriptors: *Federal jurisdiction, *Federal-state water rights conflicts, *State jurisdiction, *Legislation, Proprietary power, Water law, Treaties, Political aspects, Judicial decisions, Riparian rights, Appropriation, Mexican Water Treaty, Submerged Lands Act, Desert Land Act, Federal Power Act, Boulder Canyon Project Act, Federal government, Water rights, State governments, Legal aspects.
Identifiers: *Constitutional law, Delegation of powers.

Federal encroachment on state water rights is discussed in relation to federal constitutional law. Rather than undertaking a detailed analysis of the cases, the author confines himself to the consequences that flow from the various legal theories upon which the federal government bases its power. These include the power to regulate interstate commerce, the war power, the property clause, the general welfare clause, and the treaty power. Focusing on state water rights in the West, the author reveals how these constitutional powers have been extended through federal legislation and court interpretation to place water resources under federal control. In relation to the possible unconstitutional delegation of power over federal water rights, seventeen instances of congressional legislation recognizing the supremacy of state laws are discussed. Rather than drawing any conclusions, the author points out the legal problems and claims of the contending forces and leaves the conclusions to the reader. An appendix, outlining provisions of federal statutes in recognition of state law as governing water rights, is included. (Schram-Florida)
W70-00549

FISHING AND RECREATIONAL RIGHTS IN IOWA STREAMS AND LAKES.

Iowa L Rev, Vol 53, No 6, p 1322-1346, June 1968. 25 p, 196 ref.

Descriptors: *Iowa, *Recreation demand, *Riparian rights, *Relative rights, Legal aspects, Navigable waters, Ownership of beds, Prescriptive rights, Recreation, Riparian waters, Riparian land, Water utilization, Non-consumptive use, Navigable rivers, Non-navigable waters, Streambeds, Meanders, Public lands, Public rights, State governments, Streams, Lakes, Usufructuary right, Fishing, Federal government.

This note examines the potential recognition of a public right of recreation in Iowa waters previously thought private. The nature of riparian rights and constitutional protections thereof in Iowa's riparian system are surveyed. Rationales for asserting state control over traditionally private waters are based on one of the following: navigability, non-susceptibility of water to private ownership and exclusive control, prior use or custom, and practical considerations of the usefulness of the water for the asserted activity. These bases are discussed separately. The federal and Iowa tests of navigability are compared. Also discussed are the following: (1) relationship of navigability to bed ownership; (2) severability of bed ownership from control over the water, (3) relation of navigability to public rights; (4) state concepts of navigability; (5) trust theories and impressing private beds with public trusts; (6) state ownership of waters; (7) self-help; (8) right of access to waters; (9) the reasonable use limitation on riparian rights; and (10) the distinction between lakes and streams. The best approach to the problem would seem to be the practical considerations doctrine which balances the interests of the parties. (Marsee-Florida)
W70-00550

FISHING AND RECREATIONAL RIGHTS IN IOWA STREAMS AND LAKES.
Iowa L Rev, Vol 53, No 6, p 1322-1325, June 1968. 25 p, 196 ref.

Descriptors: *Iowa, *Recreation demand, *Riparian rights, *Public rights, Relative rights, Legal aspects, Recreation, Riparian waters, Riparian lands, Water utilization, Non-consumptive use, State governments, Usufructuary right, Fishing, Federal government, Regulation.

This note examines the potential recognition of a public right of recreation in Iowa waters previously thought private. The precise extent of the riparian interest in water suitable for public recreation has not been determined in Iowa. Riparian rights constitute property interests and are protected under both the federal and Iowa constitutions. Abrogation of those rights must be justifiable as something other than an uncompensated taking of property. Three approaches might be taken to recognize a public right in waters deemed private. First, riparian rights are not absolute but are subject to limitation within the riparian system. A dominant right, such as a public right of navigation, may limit the riparian right. Second, riparian rights are subject to reasonable state regulation in the public interest. The major problem is separating valid regulation from an invalid taking of property. Third, since riparian rights are judicial creatures, in the absence of a clearly established public policy protecting such rights they may be altered or limited by adverse adjudication. (Marsee-Florida)
W70-00551

FISHING AND RECREATIONAL RIGHTS IN IOWA STREAMS AND LAKES.
Iowa L Rev, Vol 53, No 6, p 1326-1334, June 1968. 25 p, 196 ref.

Descriptors: *Iowa, *Recreation demand, *Riparian rights, *Navigable waters, Relative rights, Ownership of beds, Legal aspects, Prescriptive rights, Recreation, Riparian waters, Riparian lands, Water utilization, Non-consumptive use, Navigable rivers, Non-navigable waters, Streambeds, Meanders, Public rights, State governments, Governments, Streams, Lakes, Usufructuary right, Fishing, Federal government.

Rationales for asserting state control over traditionally private waters seem to be based on one of the following: navigability, non-susceptibility of water to private ownership, prior use or custom, or practical considerations of the water's usefulness. Since the federal test of navigability is one of fact while the Iowa test is one of whether the body of water was meandered in the original federal survey of public lands, the question of state or federal bed ownership in Iowa is not settled. Where the bed has passed to private riparian owner, a primary obstacle to the exercise of state control over the waters is encountered. However, it appears that ownership of the bed could be severed from ownership of the waters. Various states have developed a broader test of navigability for determining public rights of recreation than has Iowa. Such broad tests can be a good starting point toward providing more state control, however, such tests would not permit fishing or other recreational rights since at common-law such rights were distinct from navigation. As a corollary to navigation, however, the public has the expanded right to use the riparian owner's shoreline. (Marsee-Florida)
W70-00552

FISHING AND RECREATIONAL RIGHTS IN IOWA STREAMS AND LAKES.
Iowa L Rev, Vol 53, No 6, p 1334-1346, June 1968. 25 p, 196 ref.

Descriptors: *Iowa, *Recreation demand, *Riparian rights, *Relative rights, Legal aspects, Navigable waters, Prescriptive rights, Ownership of beds, Recreation, Riparian waters, Riparian land, Water utilization, Non-consumptive use, Navigable rivers, Non-navigable waters, Streambeds, Meanders, Public rights, State governments, Streams, Lakes, Usufructuary right, Fishing, Public benefits, Reasonable use, Taxes.

Various approaches exist for recognizing a public right of recreation and fishing in traditionally private waters. (1) private stream beds may be impressed with public trusts; (2) prior public use of waters overlying private beds may establish a prescriptive right; (3) custom on a state-wide basis may be sufficient to circumvent traditional riparian rights; and,4) waters within the state may be declared public. These approaches fail to meet the problems involved directly. An alternative involves considering the suitability of the water for public use and balancing public against private interests. One factor to be weighed is the reasonable use limitation on the riparian owner's right; it could be applied where the owner asserts an exclusive right of use against the public. Another factor is the distinction often made between streams and lakes for recreational purposes. Such distinction hinges on practical considerations and the determination that lakes may be suitable for a greater variety of recreational uses than streams. A recognized public right of recreation in waters would be of little use without the right of access. Special tax benefits could encourage riparian owners to open public access ways. (Marsee-Florida)
W70-00553

THE CHICAGO WATER DIVERSION CONTROVERSY,
For primary bibliographic entry see Field 04D.
W70-00554

RIPARIAN RIGHTS IN FLORIDA,
Richard H. Hunt.
U Fla L Rev, Vol 8, No 4, p 393-410, Winter 1955. 18 p, 65 ref.

Descriptors: *Riparian rights, *Florida, *Navigable waters, *Non-navigable waters, Natural use, Reasonable use, Civil law, Submerged Lands Act, Beaches, Ownership of beds, Bulkheads, Sandbars, Islands, Shallow water, Oceans, Legislation, History, Legal aspects, Riparian land, Riparian waters, Coastal structures, Landfills, High water mark.
Identifiers: *Common-law riparian rights, *Sovereignty, *Divestment.

Beginning with the cession of Florida to the United States in 1819, this article traces the development of riparian rights in Florida and discusses its present status. Since riparian rights on non-navigable and navigable waters differ, navigability is defined. The common law riparian rights are discussed using the language of the courts, and court interpretations of the law are given. Riparian acts of 1856 and 1921 are detailed and their effect on the law is shown through recent court opinions. The applicability of special laws to riparian rights is briefly discussed. Riparian rights in relation to Florida's beaches and the seas bounding the state are reviewed. In discussing nonnavigable waters, determination of ownership, use, and possibility of divestment are developed. The article endeavors primarily to outline the present state of the law in Florida by showing its development and, therefore, no conclusions are drawn. (Schram-Florida)
W70-00555

RIPARIAN RIGHTS IN FLORIDA,
Richard H. Hunt.
U Fla L Rev, Vol 8, No 4, p 393-397, Winter 1955. 5 p, 20 ref.

Descriptors: *Riparian rights, *Florida, *Navigable waters, *Non-navigable waters, History, Legislation, Ownership of beds, Legal aspects, Riparian lands, Riparian waters, Navigation, High water mark, Easements, Lakes, Streams, Usufructuary right, Relative rights.
Identifiers: *Common-law riparian rights.

Except for Spanish grants of submerged lands made prior to 1818, Florida applies an admixture of common law and statutory principles in determining the riparian rights of its inhabitants. Riparian rights differ between navigable and nonnavigable waters. Navigable waters in Florida include all lakes, rivers, bays, harbors, or other waters capable of practical navigation for useful purposes. Florida courts have held waters to be navigable even if the water is only suitable for floating rafts and logs or present only at certain seasons. A prime necessity, however, is that the water in its natural state be capable of sustaining navigation without any artificial aid or improvement. Two Florida cases have resolved the common-law rights incident to riparian owners. Riparian owners share with other residents of the state the right to use these waters for navigation. They may exercise the exclusive right of access to the waters from their riparian lands, but the waters and the lands thereunder belong to the state. Riparian rights are property rights and owners cannot be deprived of them without compensation. In addition, any special injury to an owner's use and enjoyment of his riparian land is compensable. (Schram-Florida)
W70-00556

RIPARIAN RIGHTS IN FLORIDA,
Richard H. Hunt.
U Fla L Rev, Vol 8, No 4, p 398-404, Winter 1955. 6 p, 20 ref.

Descriptors: *Florida, *Riparian rights, *Navigable waters, *Riparian land, Reasonable use, Legislation, Ownership of beds, Islands, Bulkheads, Shallow water, History, Landfills, Coastal structures, Riparian waters, Legal aspects, Sandbars, High water mark.

In 1856, the Florida Legislature enacted 'An Act to Benefit Commerce.' This act vested full title to riparian shallows in the riparian proprietors in order that they might fill in the shoreline and erect warehouses and wharves. Subsequent litigation has proved, however, that absolute title remains in the state and the act is a mere grant for a particular and specially defined use. This act was extended in 1921 to vest in riparian owners the title to submerged lands from the edge of the channel to the high water mark when this land is actually filled or permanently improved. Once this is done, absolute title vests in the riparian owner. Failure to bulkhead and fill, however, subjects the owner to divestment by the state. While it is yet undecided, it appears that an owner of a bay or river island cannot extend his land area by bulkheading and filling. This also applies to sandbars and shallow banks. Both private and public rights in certain bodies of water and lands riparian thereto are regulated by innumerable special acts, population acts, and local laws which are beyond the scope of this article. (Schram-Florida)
W70-00557

RIPARIAN RIGHTS IN FLORIDA,
Richard H. Hunt.
U Fla L Rev, Vol 8, No 4, p 404-410, Winter 1955. 7 p, 25 ref.

Descriptors: *Florida, *Riparian rights, *Navigable waters, *Non-navigable waters, Reasonable use, Civil law, Submerged Lands Act, Beaches, Ownership of beds, Bulkheads, Oceans, Legislation, History, Landfills, Legal aspects, Riparian lands, Riparian waters, Seashores, Relative rights.
Identifiers: *Sovereignty, *Divestment, Nuisance.

Recognizing the need of preserving its beaches for public use, the Florida Legislature has not extended to riparian owners on the ocean or Gulf of Mexico the right to bulkhead and fill lands below the high water mark. Any such intrusion by a riparian owner is unlawful and is treated as a nuisance. The Submerged Lands Act passed by Congress in 1953, established a distance of three miles from the coast line of each state as a general offshore limit of the state's right to submerged lands. An additional section, however, extends Florida's seaward boundaries to three geographical miles on the Atlantic Ocean and nine miles on the Gulf of Mexico. If any body of water in the state is nonnavigable in fact, the bed is subject to private ownership. Although undecided, it appears that Florida will follow the civil law reasonable use theory which allows adjacent riparian owners to use the whole body of water. The common law rule, however, only permits each owner to use the water above that portion of the bed owned by him. The question of private ownership of lands under water appears to be subject to possible divestment by holding the body of water to be navigable. (Schram-Florida)
W70-00558

THE NAVIGATION SERVITUDE AND JUST COMPENSATION--STRUGGLE FOR A DOCTRINE,
For primary bibliographic entry see Field 04A.
W70-00559

REAL PROPERTY--ALLUVION AND ACCRETION--ARTICLE 509 OF THE LOUISIANA CIVIL CODE,
Philip Claverie.
Tul L Rev, Vol 39, No 3, p 611-617, Apr 1965. 7 p, 28 ref.

Descriptors: *Louisiana, *Alluvium, *Accretion (Legal aspects), *Riparian rights, Bottom sediments, Channel morphology, Thalweg, Channels, Currents (Water), Streams, Running waters, Navigable rivers, Navigable waters, Beds, Riparian waters, Lakes, Judicial decisions, State jurisdiction, Riparian land, Rivers.

The articles of the Louisiana Civil Code that treat alluvion and accretion come directly from the French Code of 1804. The French law provided that riparian owners took title to accretions in rivers and other streams, but not in lakes and ponds. The Louisiana law omitted this section of the French law as well as a codified distinction between two kinds of lakes: public lakes or navigable lakes through which currents move and private lakes or land-locked lakes or ponds. The Louisiana courts have held that a riparian owner does not acquire ownership of accretion forming in lakes, bays, or arms of the sea regardless of their navigability. In the absence of a codified distinction between true lakes and other streams, however, the courts have proceeded case by case to decide whether the particular body of water in question is a river or stream, or a lake or pond. After examining the cases on point, the author concludes that the courts have failed to formulate a definitive test for determining ownership of alluvion formed in navigable waters and urges adoption of the French distinction based upon the presence of currents in the body of water. (Kelly-Florida)
W70-00560

REAL PROPERTY: DISPOSITION OF DIFFUSED SURFACE WATERS IN NORTH CAROLINA,
For primary bibliographic entry see Field 04A.
W70-00561

THE APPROPRIATION OF PROPERTY FOR LEVEES: A LOUISIANA STUDY IN TAKING WITHOUT JUST COMPENSATION,
For primary bibliographic entry see Field 04A.
W70-00562

THE APPROPRIATION OF PROPERTY FOR LEVEES: A LOUISIANA STUDY IN TAKING WITHOUT JUST COMPENSATION,
For primary bibliographic entry see Field 04A.
W70-00563

THE APPROPRIATION OF PROPERTY FOR LEVEES: A LOUISIANA STUDY IN TAKING WITHOUT JUST COMPENSATION,
For primary bibliographic entry see Field 04A.
W70-00564

ESTUARINE LAND OF NORTH CAROLINA: LEGAL ASPECTS OF OWNERSHIP, USE, AND CONTROL,
David A. Rice.
NCL Rev, Vol 46, No 4, p 779-812, June 1968. 34 p, 169 ref.

Descriptors: *North Carolina, *Estuaries, *Tidal marshes, *Land tenure, Estuarine environment, Estuarine fisheries, Bays, Inlets (Waterways), Intertidal areas, Tides, Marshes, Wetlands, Coastal marshes, High water mark, Low water mark, Tidal effects, Navigation, Navigable streams, Riparian rights, Legal aspects, State jurisdiction.

Conservation and protection of estuarine lands in North Carolina are hampered by unresolved controversies over ownership and use of them. Historically tidelands have been held in trust for the public by the sovereign. The state has adopted this principle of British and colonial common law. If the covering water is unnavigable in fact, lands under tidewater may be conveyed to private owners. Confusion in developing a standard test of navigability, and inconsistencies in statutes permitting conveyance of marsh and swamplands have made difficult the classification of lands in regard to their susceptibility to private ownership. Other legal principles must also be considered in dealing with ownership of estuarine lands. Excluding domestic fisheries, ownership of fish and wildlife estuarine resources resides in the state. Another area of concern is ownership of land between high and low water marks. Cases have allowed conveyance where express intent is shown, but their present authority is questionable. The author further mentions statutory changes in the common law rules of accretion, reliction, avulsion, and erosion. The distinction is now between natural and artificial causes rather than between gradual and rapid land loss or gain. (Kelly-Florida)
W70-00565

COMPENSATION FOR THE RIGHT OF ACCESS TO NAVIGABLE WATERS,
For primary bibliographic entry see Field 04A.
W70-00566

THE RIGHT OF ACCESS TO NAVIGABLE WATERS--COMPENSABILITY UNDER EMINENT DOMAIN,
For primary bibliographic entry see Field 04A.
W70-00567

WATER--AS A SPECIES OF PRIVATE PROPERTY--THE ILLINOIS VIEW,
For primary bibliographic entry see Field 04A.
W70-00568

CIVIL LAW PROPERTY--BEDS OF NAVIGABLE WATERS--SUSCEPTIBILITY OF PRIVATE OWNERSHIP.
For primary bibliographic entry see Field 04A.
W70-00569

WATER BOUNDARIES,
For primary bibliographic entry see Field 04A.
W70-00570

IRRIGATION IN KENTUCKY AS AFFECTED BY THE LAW OF RIPARIAN RIGHTS,
For primary bibliographic entry see Field 03F.
W70-00571

DETERMINATION OF RIGHTS TO REAL PROPERTY ALONG THE MISSOURI RIVER IN CONNECTION WITH RIVER STABILIZATION,
For primary bibliographic entry see Field 04A.
W70-00572

IOWA WATER LAW: PROBLEMS TO BE CONSIDERED.
Iowa L Rev, Vol 42, No 1, p 102-107, Fall 1956. 6 p, 31 ref.

Descriptors: *Iowa, *Usufructuary right, *Prior appropriation, *Beneficial use, Riparian rights, Condemnation, Natural flow doctrine, Artificial use, Competing uses, Irrigation water, Industrial water, Municipal water, Legal aspects, Legislation, Navigable waters, Ownership of beds, Underground streams, Percolating water, Natural use, Water supply.

Iowa currently suffers a lack of case law and statutes regarding the use of water for consumptive purposes. Beneficial use under the riparian system raises many prospective legal questions which must be resolved. Under this system, only the riparian owner is entitled to beneficial use. In addition, the riparian doctrine only concerns itself with surface and underground streams. Thus, percolating ground water, a valuable resource for irrigation and industry, presents a problem. The greatest difficulty involves competition for available water by industry, municipalities, and irrigation and the conflict between natural and artificial uses. Because condemnation appears impractical, a water law statute regulating beneficial use may be needed. Another possible solution to Iowa's water law problems is beneficial use under the prior appropriation system. Constitutional objections as well as the resulting static condition of water rights, however, make this system unsatisfactory for adoption in Iowa. The solution of legal problems involved in establishing control of water and priority of uses through legislation must, however, await the determination of: (1) the total amount of available water; (2) present beneficial uses; (3) possible future uses; and (4) costs of developing existing and future water supplies. (Schram-Florida)
W70-00573

LITTORAL RIGHTS ON THE GREAT LAKES,
John F. Power.
Notre Dame Lawyer, Vol 20, No 4, p 424-428, June 1945. 5 p, 22 ref.

Descriptors: *Great Lakes, *Littoral, *Riparian land, *Riparian rights, Michigan, Illinois, Indiana, Shores, Boundaries (Property), Lake beds, Lakes, Lake Michigan, Parks, Lake shores, Landfills, Easements, Piers, Docks, Meanders, Accretion (Legal aspects), Legal aspects, Low water mark, High water mark, Relative rights, Contracts.
Identifiers: *Right of adjacency, *Littoral rights.

Littoral is a more accurate term than riparian when referring to ownership on lake shores. Littoral rights necessarily include the right of adjacency although courts disagree as to whether littoral title will vest to the high or low water mark. Except for special purposes, the beds of the Great Lakes are not susceptible to private ownership but are held in public trust by the state. Although early Michigan cases indicated otherwise, both Michigan and Illinois now adhere to the doctrine that littoral rights extend to the waters edge and include rights of adjacency, accretion, and access. However, some exceptional cases have arisen in Chicago where the park system is composed chiefly of filled land and the shoreline is now some distance from its original location. Those cases involve the rights of owners who surrendered their littoral rights to such parks in consideration for the promise that the parks would beautify their property and that their view would remain unobstructed. To possess littoral rights in Indiana, the owner's land must border on the water. The littoral owner's right to fill is commonly governed by legislation today. (Marsee-Florida)
W70-00574

REAL PROPERTY--WATER RIGHTS--PUBLIC RIGHTS OF FISHING AND NAVIGATION OVER FLOODED LANDS.
For primary bibliographic entry see Field 04A.
W70-00575

THE LAW OF NAVIGABLE STREAMS IN WEST VIRGINIA,
Philip B. Hill.
W Va L Rev, Vol 59, No 1, p 73-78, Dec 1956. 6 p, 32 ref.

Descriptors: *West Virginia, *Mineralogy, *Ownership of beds, *Navigable rivers, Legal aspects, Administrative agencies, Beds, Permits, Boating, Tidal waters, Virginia, Judicial decisions, Legislation, Dredging, Leases, Remedies, Royalties, Public benefits, Mining, Regulation, Classification, Navigable waters, Easements.

The West Virginia Supreme Court of Appeals held in Campbell Brown and Co v Elkins, 93 SE2d 248 (W Va 1956), that the Public Land Corporation holds title to the beds of all navigable streams in the state and that said corporation may license individuals or corporations to extract minerals from the beds of navigable streams. The test of navigability turns on whether the stream can supply a useful commercial purpose to the public. The Campbell court noted that a stream need be navigable only for such times of the year as to make it valuable to the public. It is well settled in West Virginia that the beds of all navigable streams belong to the state. The Campbell case is interpreted as showing a judicial tendency of permissiveness towards allowing grants of beds with public retention of an easement therein. Present law in West Virginia prevents optimum utilization of mineral resources; this follows because mineral extraction is only permitted through state licensing, and because of state statutes licensees have no remedy when the state revokes their licenses. Statutory leasing provisions are recommended to promote utilization of mineral resources. (Keith-Florida)
W70-00576

THE MOVEMENT FOR NEW WATER RIGHTS LAWS IN THE TENNESSEE VALLEY STATES.
R. H. Marquis, R. M. Freeman, and M. S. Heath, Jr.
Tenn L Rev, Vol 23, No 7, p 797-837, Apr 1955. 41 p, 202 ref.

Descriptors: *Southeast US, *Tennessee River, *Water rights, *Riparian rights, Water utilization, Legislation, Legal aspects, Water law, Prior appropriation, Reasonable use, Natural flow doctrine, Surface waters, Natural streams, Underground streams, Percolating waters, Industrial water, Municipal water, Irrigation, Judicial decisions.
Identifiers: Constitutions.

An increased utilization of water and several years of abnormally low rainfall have stressed the need for a reexamination of the legal rules applicable to water rights in several southeastern states. Changes proposed would replace the existing riparian rights doctrine with the doctrine of prior appropriation. Since 1952, a number of proposals have been introduced into the legislatures and several study groups have been created. Major problems in the area involve supplemental irrigation and municipal and industrial water use. A number of assumptions have been made which underlie the argument in favor of prior appropriation. Many of these are essentially invalid. The author discusses the existing law in the Tennessee Valley states and the states using the prior appropriation doctrine as they apply to (1) surface waters in well-defined streams, (2) surface waters which spread in a diffused state, (3) underground waters in well-defined streams, and (4) underground percolating waters. The author also notes the constitutional questions raised by legislation which would destroy unused riparian rights without compensation. He argues that there are possible alternatives stressing the advantages of both legal doctrines. (Heckerling-Florida)
W70-00577

POLLUTION OF WATERS OF STATE.
For primary bibliographic entry see Field 05G.
W70-00578

OLLUTION OF WATERS OF THE STATE: HE STREAM POLLUTION CONTROL BOARD F THE STATE OF INDIANA.

or primary bibliographic entry see Field 05G.
V70-00579

OLLUTION OF WATERS OF STATE.

or primary bibliographic entry see Field 05G.
V70-00580

OLLUTION OF WATERS OF STATE.

nd Ann Stat secs 68-535 thru 68-543 (1961).

escriptors: *Indiana, *Water pollution control, Eminent domain, *Administrative agencies, egislation, State governments, Water conserva- on, Standards, Pollution abatement, Interstate, lethodology, Decision making, Inter-agency ooperation, Regulation, Cost sharing, Condemna- on, Grants, Waste disposal, Water quality control, Vater quality.
dentifiers: *Water Pollution Control Act.

he Stream Pollution Control Board is the water ollution agency for this state and is authorized to epresent the state in all matters relating to water ollution, to secure the benefits of the Federal Vater Pollution Control Act, to develop interstate rograms for the elimination or reduction of pollu- ion, to approve municipal applications for loans or rants under the Act, and to participate through its uthorized representatives in proceedings under he Act. The Board may condemn land when or- ered to control, treat, and dispose of industrial nd sanitary wastes. Provisions are made for a hear- ng in which a landowner may contest the necessity f a condemnation order. A landowner also retains is customary right to defend in proceedings in minent domain. Condemnation of land is rohibited if there is a dwelling house located hereon at the time the act goes into effect. Schram-Florida)
V70-00581

SWAN ISLAND CLUB V YARBROUGH (LANDS IELD IN TRUST FOR PUBLIC).

09 F2d 698-703 (4th Cir 1954).

Descriptors: *North Carolina, *Ownership of beds, Navigable waters, Boundaries (Property), Public enefits, Recreation, Hunting, Navigation, Legisla- ion, State governments, Public rights, Judicial ecisions, Remedies, Legal aspects, Water law.
dentifiers: Torrens Land Act.

Plaintiff owned land lying between the Atlantic Ocean and a North Carolina sound. Some of this and was covered by navigable waters. He sought to njoin alleged trespasses by defendants who main- ained duck blinds within the area plaintiff claimed. The district judge decreed for defendants and laintiff appealed. The court, agreeing with the dis- rict judge, held that the Torrens Land Act, upon vhich plaintiff's claims rested, did not have the ef- ect of vesting title in plaintiff to lands covered by avigable waters. Navigable waters cannot be nonopolized. Title to the land under such waters is eld by the state in trust for the use of the public. A rant of such lands has never been adjudged to be vithin the legislative power. The purpose of a roceeding under the Torrens Land Act is to emove clouds from title, not to validate title to ands which under the laws of the state are not sub- ect to private ownership. Even if title had vested in laintiff, it would be subject to the same trust on ehalf of the public as would be in effect if title were held by the state. (Gabrielson-Florida)
W70-00582

DEPARTMENT OF CONSERVATION.

For primary bibliographic entry see Field 04C.
W70-00583

DUTIES OF MINNESOTA LAND EXCHANGE COMMISSION.

Minn Stat Ann secs 94.341-94.52 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Land development, *Administrative agencies, *Forests, Forest management, Parks, Public land, Surveys, Wildlife conservation, Conservation, Land classification, Land appraisal, Land clearing, Land management, Land use, State governments, Federal government.
Identifiers: State forests.

The Minnesota Land Exchange Commission is responsible for the development of state forests and is authorized to: (1) acquire or lease lands for state forest and conservation purposes from the federal government or private citizens; (2) sell, lease, or exchange lands within its jurisdiction; (3) sue to quiet title to land within its authority; (4) make rules and regulations concerning the exchange of state lands; and (5) enter into agreement with federal officials toward the development of state lands. State land that may be exchanged is in three classes. The state retains certain mineral and water rights in exchanged lands. Title opinions by the Attorney General or the county attorney involved on land exchanged or to be exchanged must be submitted and approved by the Commission prior to a final exchange. The Reclamation Board has the duty to improve state swamp, stump, or cut-over lands for cultivation and sale. Municipalities and counties may grant land to the federal government for government purposes. (McDonough-Florida)
W70-00584

NETS AND SEINES, STURGEON, SHAD, AND HERRING SEASON.

Md Ann Code Art 66C secs 286 thru 292A, 294, 295 (1957).

Descriptors: *Maryland, *Fish conservation, *Nets, *Commercial fishing, Virginia, Tidal waters, Low water mark, Regulation, Headwaters, Downstream, Fishing, Equipment, Gill nets, Legislation, Fishing gear, Legal aspects, Seasonal.
Identifiers: *Non-tidal waters, *Fishing seasons.

The use of nets of certain lengths and types is regulated in designated areas of the Chesapeake Bay and the Patuxent River. Nets are prohibited in the Severn and Wicomico rivers, and their use limited to specified seasons in the Choptank and Mogothy rivers. Regulations concerning rod, hook, and line fishing in the Severn River are set forth. Fishing seasons for shad and herring are designated, and sale of fresh shad out of season is prohibited. The Department of Chesapeake Bay Affairs is authorized to regulate the taking of sturgeon in Maryland, and all seasons in Maryland are required to coincide with those in Virginia. (Harris-Florida)
W70-00585

OPERATION AND EQUIPMENT OF VESSELS.

Iowa Code Ann secs 106.1-106.8 (Supp 1969).

Descriptors: *Iowa, *Boating regulations, *Ships, *Accidents, Legislation, Legal aspects, Navigation, Damages, Administrative agencies, Conservation, Boating, State governments, Jurisdiction, Safety.
Identifiers: Motorboats.

It is the policy of this state to promote safety for persons and property in and connected with the use, operation, and equipment of vessels and to promote uniformity of laws relating thereto. The state conservation commission shall enforce these provisions. The operation of unnumbered motorboats is prohibited. Provisions are made for the registration and identifying by number of motorboats. Certain specified vessels are exempt from the provisions of this chapter. The operator of a vessel involved in a collision shall render such assistance as may be practicable and necessary. A report shall be filed with the commission giving any necessary information about the collision. All reports shall be confidential. When any request is made by an authorized official or agency of the United States, any information compiled or otherwise available to the commission under this act shall be transmitted to said official or agency. (Heckerling-Florida)
W70-00586

WATER NAVIGATION REGULATIONS.

Iowa Code Ann secs 106.18-106.34 (Supp 1969).

Descriptors: *Iowa, *Navigation, *Boating regulations, *Water sports, Legislation, Legal aspects, Boats, Inspection, Right-of-way, Artificial watercourses, Lakes, State governments, Structures, Buoys, Ice, Safety, Regulation, Administrative agencies.
Identifiers: Registration, Licenses.

The owner and operator of any undocumented vessel shall be liable for any injury or damage occasioned by the negligent operation of such vessel. One or more persons shall be appointed as boat inspectors and water safety patrolmen. All boats on any waters of this state must be inspected annually. Boat inspectors shall determine whether a boat is seaworthy. Any engineer or pilot on a vessel must have a license. Boat inspectors shall have the power to suspend or revoke the registration of any vessel for any of the herein enumerated reasons. Provisions are also made concerning overloading of vessels, rights-of-way rules, the removal of nonpermanent structures, and the drydocking of vessels failing to pass inspection. Certain types of watercraft are prohibited on artificial lakes. The use of buoys and driving on ice are regulated. Emergency vessels are given the right of way. (Heckerling-Florida)
W70-00587

FISH AND GAME.

Ark Stat Ann secs 47-501 thru 47-534 (1964).

Descriptors: *Arkansas, *Fish, *Wildlife, *Recreation, Legislation, Regulation, Fishing gear, Equipment, Nets, Boats, Water sports, Sport fishing, Fish management, Animal control, Commercial fishing, Dams, Streams, Lakes, Ponds, Legal aspects.
Identifiers: Penalties (Civil).

Miscellaneous provisions relating to hunting and fishing are provided. Game and fish are state property. Regulations concerning the unlawful possession of game, cold storage of game, non-resident permits to carry and ship game out of state, waste of game, firesetting, altering licenses, sale of confiscated fish and game together with penalties for violation thereof are set forth. Provisions for bringing game into the state, exporting and shipping game out of the state, sale of game fish raised in private waters, and applicable penalties are enumerated. Provisions regarding the control of dams or other obstructions, the screening of intake pipes used in the withdrawal of water from public watercourses, and the lowering of stage water are set forth. The duties of officers regarding enforcement of fish and game laws, and the duties of the prosecuting attorney, together with provisions for the disposition of fines and confiscation of fish and game, are included. The posting of lands, including commercial fish farms and manmade water storage reservoirs, is authorized. Hunting or fishing on such posted lands is unlawful. (Moulder-Florida)
W70-00588

BROWN V BOWLES (OFFSHORE FISHING RIGHTS).

254 A2d 696-700 (Md 1969).

Descriptors: *Maryland, *Fishing, *Interstate compacts, *Riparian rights, Rivers, Judicial decisions, Legislation, Land tenure, Islands, Remedies, Nets,

Virginia, Riparian land, Legal aspects, Interstate, Relative rights.
Identifiers: *Potomac River.

Plaintiff brought this suit to enjoin defendant from hauling a seine along the shore of an island located in the Potomac River and owned by plaintiff. On a number of occasions defendant had fished nearer than 100 yards from the shore of the island without permission and against the will of plaintiff. Plaintiff contended that the entry by defendant violated a state law which would give plaintiff first priority in seining in front of the property which he owned. The statute in question was enacted unilaterally by Maryland and never received the consent and approval of Virginia. The court discussed whether the statute abrogated a prior compact between Maryland and Virginia dating from 1785. If the 1785 Compact was still in effect, mutual consent of both states would be required for the statute to be effective. The court concluded that the Compact was still in effect and further that the statute plaintiff relied on was never intended to apply to that area of the Potomac within the jurisdictional boundary of the Compact. Since plaintiff's island was within the boundary of the Compact, judgment was for defendant. (Heckerling-Florida)
W70-00589

PROVISIONS AS TO DITCHES, DRAINAGE, AND RECLAMATION.
For primary bibliographic entry see Field 04A.
W70-00590

INDIANA BOARD OF PUBLIC HARBORS AND TERMINALS.

Ind Ann Stat sec 68-703 (1961).

Descriptors: *Indiana, *Harbors, *Port authorities, *Optimum development plans, Administrative agencies, Inter-agency cooperation, Programs, Feasibility studies, Cost sharing, Project planning, Grants, Eminent domain, Condemnation, Channel improvement, Navigation, Transportation, Construction, Structures.
Identifiers: Water terminals, Harbor construction.

The Indiana Board of Public Harbors and Terminals has been abolished. The powers given to this Board have been transferred to the Indiana Port Commission. The powers and duties enumerated in this act include the authority: (1) to carry on negotiations with the federal government for construction of public harbors and terminals in Indiana; (2) to purchase and sell land in connection with such public harbors and terminals; (3) to accept grants from any public or private agency, corporation, or individual for such site or to pay the expenses of the Board; (4) to purchase or accept grants of easements for widening of channels into such public harbors or terminals; (5) to construct a public harbor or terminal; (6) to condemn property to carry out the purposes and intent of this act; and (7) to prepare sketches, plans, and descriptive material for any such harbor or terminal, to compile data as to the necessity and advisability thereof, and to publish same and do any other act to promote any such harbor or terminal in the public interest. (Schram-Florida)
W70-00591

GREAT LAKES BASIN COMPACT.

Ind Ann Stat secs 68-901 thru 68-905 (1961).

Descriptors: *Indiana, *Great Lakes, *Interstate commissions, *Interstate compacts, Long-term planning, Natural resources, Conservation, Legislation, Lakes, Utilities, Harbors, Navigation, Fisheries, Stabilization, Water pollution control, Erosion control, Hydroelectric plants, Water utilization, Planning, Water conservation, Water levels, Flood control, Diversion, Water resources development, River basin development.

The Great Lakes Commission is hereby created. Each member state is entitled to three votes. The Commission shall have the power to: (a) collect, correlate, interpret, and report data relating to the water resources and the use thereof in the Great Lakes basin; (b) recommend methods for the development and conservation of the water resources; (c) consider the need for public works and improvements relating to water resources; (d) consider the means of improving navigation and port facilities; (e) consider the means of improving and maintaining fisheries; (f) recommend policies relating to water resources; (g) recommend laws relating to water resources; (h) prepare and publish reports and bulletins; (i) recommend agreements between the United States and Canada. Each party state agrees to consider the action the Committee recommends with respect to: stabilization of lake levels; pollution, erosion, and flood control measures; uniformity in navigation regulations, in fishing laws, and other water resource laws; suitable hydroelectric power developments; and diversion of waters from and into the basin. All the officers of this state are directed to help accomplish the purposes of this compact. (Smith-Florida)
W70-00592

FISH AND GAME.
Ind Ann Stat secs 11-1649 thru 11-1667 (1956), as amended, (Supp 1968).

Descriptors: *Indiana, *Fish, *Fish barriers, *Fish conservation, Legislation, Regulation, Frogs, Mussels, Streams, Dams, Minnows, Permits, Fish hatcheries, Fish management, Conservation, Fishing.
Identifiers: Penalties.

It is unlawful to set any obstruction other than a dam across a stream which prevents the free passage of fish. It is unlawful to use trot lines, set lines, or throw lines within fifty yards of any dam. It is unlawful to fish in a state-owned fish hatchery. Beaver Dam Lake is set aside for experimentation purposes and no person shall catch fish from the spawning ground therein or fail to report the catch, if taken outside the spawning ground, to the director of the Department of Conservation. A permit is required prior to taking more than five hundred live minnows. Hatchery-bred fish may be sold under regulations promulgated by the Department of Conservation. A license is required before engaging in the selling of minnows for bait. It is unlawful to export minnows from the state except for purposes of sale. Applicable penalties are provided. (Moulder-Florida)
W70-00593

DRAINAGE MAINTENANCE AND REPAIR DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00594

DRAINS: RIGHT-OF-WAYS--OBSTRUCTIONS--CROSSINGS--CONNECTIONS.
For primary bibliographic entry see Field 04A.
W70-00595

INDIANA DEEP WATERWAYS COMMISSION.
For primary bibliographic entry see Field 04A.
W70-00596

PUBLIC WORKS AND CERTAIN PUBLIC AUTHORITIES.

SC Code Ann secs 59-8, 59-14, 59-15 (1962).

Descriptors: *South Carolina, *Administrative agencies, *River basin development, *Water resources development, Navigation, Rivers, Reclamation, Floods, Flood control, Public health, Taxation, Electric power, Local governments, Hydroelectric power, Lakes.

The primary purpose for the creation of the Public Service Authority is the development of the Santee, Cooper, and Congaree rivers as instrumentalities of interstate, intrastate, and foreign commerce and navigation, reclamation of wastelands through flood control projects, and reforestation and improvement of public health in affected areas. Such aid and development is in all respects for the public benefit and is a public purpose. The Public Service Authority cannot be required to pay taxes on any activities or property acquired. Securities issued by the Authority are free from taxation. However, in determining the rate of sale for electric power, the taxes the Authority would have paid if privately owned, are properly to be considered. The Authority shall pay to various counties, municipalities, and school districts situated therein, a sum of money equivalent to the amount paid for taxes on properties at the time of their acquisition by the Authority. The Authority may construct the Santee-Cooper hydroelectric and navigation project as outlined by the Federal Power Commission. One lake constructed by the Authority and belonging to the state, located on the Cooper River near Pinopolis, shall hereafter be known as Lake Moultrie. The other lake so-owned and constructed in that area shall be known as Lake Marion. (Carruthers-Florida)
W70-00599

RIVER AND HARBOR IMPROVEMENTS.
For primary bibliographic entry see Field 04A.
W70-00696

DRAINAGE DISTRICTS UNDER 1911 ACT.
For primary bibliographic entry see Field 04A.
W70-00715

CONOBRE V FRITSCH (NATURAL WATERCOURSES).
For primary bibliographic entry see Field 04A.
W70-00720

APPEAL TO WATER RESOURCES BOARD.
W Va Code Ann, secs 20-5A-15 thru 20-5A-16 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Legislation, Permits, Judicial decisions, State governments, Legal aspects, Administrative agencies, Water resources, Waste treatment, Sewage disposal.
Identifiers: *Judicial review.

Any person adversely affected by an order made and entered by the Chief of the Division of Water Resources or aggrieved by his failure to act may appeal to the Water Resources Board. Notice of appeal will not stay the execution of the order unless the Board or the Director of the Department of Natural Resources finds its execution will result in unjust hardship for the plaintiff. For the purposes of conducting such appeal hearing, any member of the Board and the Secretary thereof may issue subpoenas and subpoenas duces tecum in the name of the Board. After hearing all of the testimony, evidence and record in the case, the Board can affirm, modify, or vacate the order of the Chief. In reading this decision the Board considers not only the factors the Chief was authorized to consider but also the economic feasibility of treating and/or controlling the sewage or waste involved. The Chief of the Division of Water Resources or any person adversely affected by a final order made and entered by the Board after such appeal hearing is entitled to judicial review thereof. (Gabrielson-Florida)
W70-00734

CASTAWAYS MOTEL V SCHUYLER (PERMISSION TO BUILD A BULKHEAD).

24 NY 2d 120, 299 NYS 2d 148-153 (1969).

Descriptors: *New York, *Bulkheads, *Beds, *Hydroelectric plants, Legal aspects, Judicial deci-

ions, Port authorities, Public lands, Ownership of beds, Patents, Docks, Obstruction to flow, Recreation, Conservation, Administrative agencies, Retaining walls, Regulation, Control, Administration, St. Lawrence River, Ice, Construction projects, Project purposes.
Identifiers: *Covenants, *Breakwalls, *Niagara River, Yacht clubs, Ice damages.

Plaintiff motel owner applied to defendant Commissioner of General Services for permission to construct a bulkhead in the Niagara River to protect the former's docks from ice damage caused by the Power Authority's Niagara project. Consent was given to begin construction while plaintiff's application was pending. On a determination that plaintiff's bulkhead would not interfere with the power project, defendant approved plaintiff's application, but this approval was contingent upon plaintiff's signing a release to the state and the power authority from any claims occasioned at any time. Plaintiff brought an action in Special Term to compel defendant to approve his application without the condition. Special Term dismissed the petition, Appellate Division affirmed, and plaintiff appealed. Aside from the procedural issues, the Court of Appeals held that applications under Section 75 of the Public Lands Law, dealing with grants of land under water, may be made to promote commerce, insure beneficial enjoyment by owners, or for agricultural purposes, for public park, beach, recreation, or conservation purposes. Since plaintiff's application was for his beneficial use and a determination had been made that plaintiff's bulkhead would not interfere with the power project, his application should have been unconditionally granted. (Keith-Florida)
W70-00735

ILLINOIS DRAINAGE CODE.

Ill Ann Stat ch 42, secs 3-1 thru 3-31 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Drainage, *Drainage districts, *Levees, Local governments, Agriculture, Environmental sanitation, Mining, Mine wastes, Engineering, Legislation, Outlets.

Drainage districts may be formed to engage in drainage or levee work for agricultural, sanitary, or mining purposes. Such districts may be organized upon a petition by landowners in the proposed district. After determining the validity of such petition the court shall appoint commissioners who shall examine the area proposed, employ an engineer to report to them, and file a report with the court. A hearing will be held after which the court will either dismiss the proposal or order the organization of the district. This order is final and is appealable. An alternative method of organization is the referendum submitted to the voters upon petition by interested landowners of the proposed district. Outlet drainage districts may be organized by either of the above procedures. Such districts are to aid two or more drainage districts by improving general outlets. Mutual drainage districts may be formed upon agreement of landowners requiring combined drainage facilities to protect their land. The procedure for organization will be the same as either of the above unless the agreement specifies otherwise. (Darragh-Florida)
W70-00737

WEST CENTRAL MISSISSIPPI WATERWAY COMMISSION.
Miss Code Ann secs 5956-301, 5956-306 (Supp 1968).

Descriptors: *Mississippi, *Channels, *Multiple-purpose projects, *Investigations, Legislation, Legal aspects, Public benefits, Navigation, Recreation facilities, Flood control, Irrigation, Water supply, Water resources development, Administrative agencies, Water utilization.

The West Central Mississippi Waterway Commission is created for the purpose of coordinating the effort necessary to develop and create a multipurpose waterway through several specified counties. The Commission is concerned with investigation, feasibility determination, development, and creation of the aforementioned multipurpose waterway. The duties of the Commission include the investigation of the possibility of creation and utilization of a domestic water supply, an industrial water supply, irrigation facilities, flood control facilities, power facilities, navigation facilities and recreation facilities as might be made available from the aforementioned waterway. (Keith-Florida)
W70-00738

STATE OWNERSHIP AND SALE OF SEA SHELLS.
Miss Code Ann secs 6048-01 thru 6048-03, 6048-08 (Supp 1968).

Descriptors: *Mississippi, *Shellfish, *Dredging, *Aquatic life, Legislation, Legal aspects, Oysters, Clams, Regulation, Mussels, Reefs, Beds, Banks, Jurisdiction, Contracts, Tidal waters, Administrative agencies, Commercial fishing, Conservation, Dredging, Financing, Control.
Identifiers: *Shells, *Marine biology, Seafood industry, Cay shells.

All shells of any shellfish within the territorial jurisdiction of the state are the property of the state. The Mississippi Marine Conservation Commission has authority over and control of all such shells. The Commission may contract for the sale of such shells to provide funds necessary for the operation of the Commission. Before the Commission grants any contract for the sale, dredging, and removal of shells, it must obtain a study by a marine biologist to determine whether such dredging can be done without harm to marine life; the Commission must also consult with the Gulf Coast Research Laboratory regarding these matters. The Commission closely regulates the removal of all shells. The Commission pays ten per cent from the proceeds of shell sales to the Gulf Coast Research Laboratory and may appropriate a sum not to exceed twenty-five hundred dollars per year to the Gulf States Marine Fisheries Commission. (Keith-Florida)
W70-00739

ILLINOIS PLANNING STUDIES AND COORDINATING ACTIVITIES,
Illinois State Board of Economic Development.
For primary bibliographic entry see Field 06B.
W70-00754

DRAINAGE DISTRICTS UNDER 1911 ACT: ORGANIZATION, POWERS AND EMPLOYEES OF COMMISSION; FEES, ETC.
For primary bibliographic entry see Field 04A.
W70-00759

THE CONSTITUTIONALITY OF EFFLUENT CHARGES,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05G.
W70-00766

A FRESH APPROACH TO WATER LAW,
For primary bibliographic entry see Field 06B.
W70-00768

LAWS OF FLORIDA GOVERNING WATER USE,
For primary bibliographic entry see Field 06D.
W70-00769

NORTH CAROLINA AND OTHER ATLANTIC STATES,
Claude L. Love.
Part of 'Water Law in the Eastern United States--A Symposium'. Am Water Works, Ass'n J, Vol 49, No 6, p 721-727, June 1957. 7 p, 10 ref.

Descriptors: *Natural flow doctrine, *Prior appropriation, *WATER ALLOCATION (Policy), *Water policy, Legislation, Water utilization, Beneficial use, Competing uses, Water rights, Riparian rights, Appropriation, Preferences (Water rights), Water conservation, Administrative agencies, Administration, Water law.

As local water supplies in the eastern United States continue to diminish and consumption increases, there is a growing need for legislation dealing with conservation and the equitable distribution of water. Generally, the eastern states with plentiful water supplies have been able to rely solely on the riparian doctrine to control water use. An examination of the legislation of the New England states and North Carolina reveals few statutes regulating the use of water. But, the riparian doctrine is a haphazard and fortuitous method of allocating water rights and as water supplies become limited it would seem wisest for state legislatures to learn from the experience of the drier western states and enact systems of water appropriation. Any legislation creating a system of appropriation should protect vested property rights, insure the greatest beneficial use of water resources, and conserve water resources. An administrative agency should be given the authority to determine rights to water use, to allocate water upon application, and to modify or cancel such allocations when circumstances and needs have changed. Bills have been introduced in the legislatures of several southern states which conform to these suggestions. (Gabrielson-Florida)
W70-00770

FEDERAL AIR AND WATER CONTROL: THE APPLICATION OF THE COMMERCE POWER TO ABATE INTERSTATE AND INTRASTATE POLLUTION,
For primary bibliographic entry see Field 05G.
W70-00771

SEDENTARY FISHERIES AND ARTICLE 2 (4) OF THE CONVENTION ON THE CONTINENTAL SHELF - A PLEA FOR A SEPARATE REGIME,
L. F. E. Goldie.
Am J Int L, Vol 63, No 1, p 86-97, Jan 1969. 12 p, 36 ref.

Descriptors: *Marine fisheries, *International law, *Continental Shelf, *Natural resources, Treaties, Prescriptive rights, Fish conservation, Fisheries, International waters, Law of the sea, Coasts, Marine geology, Fish management, Commercial fishing, Mussels, Oceans, Legal aspects, Legislation, Ownership of beds, Natural resources.
Identifiers: *Sedentary fisheries.

The sedentary fisheries provision of the 1958 Convention on the Continental Shelf defies determinability as to the exploitation of resources of the shelf and as to what species among natural resources of the shelf are to be covered by its terms. The provision was grafted onto a regime aimed at regulation and exploitation of mineral resources. It is feared that retention of the present article on sedentary fisheries will lead to enclosure movements by coastal states extending exclusive off-shore sedentary fishery rights. The author recommends the deletion of the present provision from the convention and suggests a variation of a 1951 International Law Commission proposed sedentary fisheries regime. This regime would require: (1) that sedentary fisheries be limited to specified species and areas wherein each fishery has been historically carried on; (2) that acquired rights of foreign fishermen based on historical practices should allow them to participate in the fisheries; and, (3) that these acquired rights be subordinated to the rights of the coastal state on the principle of abstention for economic management of the fisheries. All

regimes should be limited to specified depths on the shelf. Modifications could also be accomplished through treaty regimes. (McDonough-Florida)
W70-00772

UNITED STATES LEGISLATION RELATING TO THE CONTINENTAL SHELF,
Oliver L. Stone.
Int'l and Comp L Q, Vol 17, No 1, p 103-117, Jan 1968. 15 p, 57 ref.

Descriptors: *Continental shelf, *Submerged Lands Act, *Oceans, *Ownership of beds, Legislation, Federal government, Continental slope, Continental margin, Navigable waters, Beds, Tidal waters, Aquatic soils, Subsoil, Underwater, Beds under water, Oil, Natural gas, Mineralogy, Inlets (Waterways), Federal-state water rights conflicts, Federal jurisdiction, State jurisdiction, Leases, Exploitation, Drilling, Core drilling, Exploration, Law of the sea, Continental shelf.
Identifiers: Inland waters.

The Submerged Lands Act vests in the coastal states ownership of lands beneath navigable waters, including submerged lands lying within three nautical miles of the coast line. The seaward limit of inland waters remains unsettled, but the dispute over federal-state ownership of the inner continental shelf has been resolved in favor of the states. Following a proclamation by President Truman in 1945, which asserted jurisdiction and control over the continental shelf, the Outer Continental Shelf Lands Act extends exclusive jurisdiction and control of the subsoil and seabed out to whatever limit the United States is legally capable of reaching The Secretary of the Interior is authorized to lease gas, oil, and other mineral rights to private industry. The Act applies the whole body of federal law to the subsoil and seabed of the outer continental shelf plus laws of adjacent states that are not inconsistent. The seaward limits of the Act are flexible, subject to particularizing by the courts according to contemporary concepts and not limited by the often used 100 fathom figure. It has been assumed that the Secretary's leasing authority is co-extensive with the assertion of valid jurisdiction over the continental shelf. (Douberley-Florida)
W70-00773

CURRENT DEVELOPMENTS IN GROUND WATER LAW.
For primary bibliographic entry see Field 04B.
W70-00774

RIGHTS OF WAY FOR DRAINAGE.
For primary bibliographic entry see Field 04A.
W70-00775

CURRENT LEGISLATION,
Herbert J. Slaughter.
Fed B J, Vol 6, No 3, p 316-324, Apr 1945. 9 p, 25 ref.

Descriptors: *Legislation, *Tennessee Valley Authority Project, *Federal project policy, *Project purposes, Federal government, Management, Regions, Water resources development, Project planning, Multiple-purpose projects, Columbia River Basin, Administration, Governments, Interagency cooperation, Interstate, Political aspects, Planning, Long-term planning, River basin development, Administrative agencies.

A comparison is made between Congressional bills which have organizational forms patterned after the Tennessee Valley Authority. The Murray bill for the Missouri Valley Authority seeks to centralize the control of all regional programs in a single multi-purpose agency, managed by three directors. The bill envisions a single comprehensive plan for development of the valley and execution of the plan by a single federal agency. The Mitchell bill for the Columbia Valley Authority seeks to integrate the Authority into the general government organizational pattern. A national board supervised by the Secretary of the Interior would review all plans and coordinate them with other agencies. The Interior Department bill seeks to gear agencies more closely to the people concerned in accordance with regional and national plans of natural resources development. Secretary of the Interior supervision and close financial control assures an orderly development of national resources through existing agencies. The Rankin bill proposes nine authorities to cover the entire nation, each controlled by a separate administrator and coordinated by the President. The author cautions against programs that ignore existing agencies and working arrangements. (Douberley-Florida)
W70-00776

THE WANDERING MISSOURI RIVER: A STUDY IN ACCRETION LAW,
Robert E. Beck.
N D L Rev, Vol 43, No 1, p 429-466, Fall 1966. 38 p, 163 ref.

Descriptors: *Accretion (Legal aspects), *Missouri River, *Avulsion, *Riparian rights, Riparian land, Boundaries (Property), Rivers, Levees, Dams, Flood protection, Iowa, North Dakota, South Dakota, Kansas, Missouri, Nebraska, Montana, Judicial decisions, Water law, Legal aspects, River flow.

The Missouri River, a stream whose course has long been characterized by rapid changes and alterations, provides the background for a study of accretion law. A discussion of the historical rationales behind the basic accretion doctrine is presented. The author notes that the seven states bordering the Missouri River all apply the accretion doctrine to the stream in spite of its vagrant nature. However, because of the river's frequent wandering, it is particularly difficult to distinguish accretion from avulsion. The characteristics of avulsion and the evidentiary problems in proving it are discussed. A review is presented of case decisions in the states bordering the Missouri River concerning the ownership of riparian land which has been completely submerged but at a later date is bared and readily identifiable. It is suggested that these states re-introduce a consideration of the time element in deciding cases of this nature. Such a consideration would allow the courts flexibility which does not presently exist. (Gabrielson-Florida)
W70-00777

THE WANDERING MISSOURI RIVER: A STUDY IN ACCRETION LAW,
Robert E. Beck.
N D L Rev, Vol 43, No 1, p 429-439, Fall 1966.

Descriptors: *Accretion (Legal aspects), *Missouri River, *Avulsion, *Riparian rights, Riparian land, Boundaries (Property), Alluvium, Erosion, River flow, Legal aspects, Iowa, North Dakota, South Dakota, Kansas, Missouri, Nebraska, Montana, Judicial decisions, Water law, Access routes.
Identifiers: Dereliction, Reliction.

The wandering nature of the Missouri River has placed a heavy burden on the law of accretion, especially where formerly inundated land is again bared. This situation is the focal point of this article. Accretion, dereliction, erosion, avulsion, and alluvion are distinguished and defined. Generally alluvion formed by accretion or reliction belongs to the owner of the adjacent land, irrespective of who owned the bed at the time. However, when avulsion occurs, ownership does not change. Six rationales exist for shifting boundaries when accretion and reliction are involved: (1) new land, by accession, ought to belong to the land to which it was added; (2) the river is a natural boundary and when the river moves, the boundary moves; (3) since accretion is gradual and imperceptible, it is a trifle with which the court will not concern itself; (4) the adjacent owner is in the best position to make productive use of the land; (5) since the riparian owner is subject to the risk of loss by action of the water, he ought to benefit from a gain; and (6) the right of access to the water must be preserved. (Marsee-Florida)
W70-00778

THE WANDERING MISSOURI RIVER: A STUDY IN ACCRETION LAW,
Robert E. Beck.
N D L Rev, Vol 43, No 1, p 439-451, Fall 1966.

Descriptors: *Accretion (Legal aspects), *Missouri River, *Avulsion, *Riparian rights, Riparian land, Boundaries (Property), Rivers, Levees, Dams, Iowa, North Dakota, South Dakota, Kansas, Missouri, Nebraska, Montana, Judicial decisions, Water law, Legal aspects, River flow, Alluvium, Erosion, Riprap, Relative rights.
Identifiers: Reliction.

Since the doctrine of accretion requires gradual and imperceptible change, an important question is whether the law of accretion applies to the quick-changing Missouri River at all. Generally, courts have applied the law of accretion to the Missouri. Another problem is distinguishing between accretion, reliction, and erosion on one hand and avulsion on the other. The article looks in detail at the differences between erosion and avulsion. In determining whether avulsion, accretion, reliction, or erosion has taken place, at least four categories concerning evidence or proof can be established: (1) eye-witness testimony as to the rapidity of the action; (2) soil composition and other geological data; (3) size and kind of vegetation; and (4) presumptions. Several courts have accepted a rebuttable presumption in favor of accretion. The question of how man-made activity on the River affects the doctrine of accretion should also be considered, especially in light of recent stabilization work. Generally, Missouri River courts have deemed irrelevant the fact that alluvion has formed because of artificial barriers such as dams, levees, or dikes unless the riparian owner involved has been primarily responsible for its creation. (Marsee-Florida)
W70-00779

THE WANDERING MISSOURI RIVER: A STUDY IN ACCRETION LAW,
Robert E. Beck.
N D L Rev, Vol 43, No 1, p 451-466, Fall 1966. 38 p, 163 ref.

Descriptors: *Accretion, *Missouri River, *Avulsion, *Riparian rights, Riparian land, Boundaries (Property), Rivers, Levees, Dams, Iowa, North Dakota, South Dakota, Kansas, Missouri, Nebraska, Montana, Judicial decisions, Water law, Legal aspects, River flow, Alluvium, Erosion, Relative rights, Legialation, State governments, Regulation, Control.

In applying the accretion doctrine to such rapid changes as occur on the Missouri River, two questions seem of primary importance. How important are the theories underlying the accretion doctrine today. Who are competing for a particular tract of land, private parties or a private party versus the state. A review is presented of case decisions in the states bordering the Missouri River concerning the ownership of riparian land formerly inundated but later bared and readily identifiable. It is concluded that: (1) these states should re-introduce a consideration of the time element in deciding cases of this nature; (2) all seven Missouri River states have accepted the doctrine of accretion notwithstanding the quick-changing nature of the Missouri; (3) the accretion doctrine should be applied when the contest involves a private party versus the state, and the presumption should be in favor of accretion as contrasted with avulsion; (4) legislation should not be necessary to import the time element consideration into the determination of disputes, but this may be the best route; and (5) the time element consideration should apply to

both government and private boundary lines. (Marsee-Florida)
W70-00780

COMPENSATION FOR TAKING OF FLOWAGE EASEMENTS BY CONDEMNATION,
For primary bibliographic entry see Field 04A.
W70-00781

TIDELANDS IN SOUTH CAROLINA: A STUDY IN THE LAW OF REAL PROPERTY,
W. Turner Logan, and Ruth Williams.
S C L Rev, Vol 15, No 3, p 657-676, 1963. 20 p, 49 ref.

Descriptors: *South Carolina, *Public lands, *Land tenure, *Tidal marshes, High water mark, Low water mark, Tidal waters, Navigable waters, Estuaries, Legal aspects, Boundaries (Property), Ownership of beds, Marshes, Wetlands, Land reclamation, Judicial decisions, Riparian rights, Navigable rivers, Reclamation.
Identifiers: Adverse possession.

It is commonly stated that land between the high and low water marks of tidal navigable streams (hereinafter referred to as marshland) belongs to the public, and that the state holds it in trust. The author questions the applicability of this theory in South Carolina. Older decisions indicate that marshlands are grantable, and only dictum in one often-cited case contradicts this. More recent holdings have permitted private ownership of marshlands. Case law in South Carolina suggests that adverse possession may operate against the state. If marshland is susceptible to private ownership, a 'presumption of grant' from the state should apply to marshland to the same extent as it does to other grantable state lands. The value of marshland in terms of reclamation and in regard to agricultural potential, to hunting, and to mineral deposits, demands that a new and critical analysis of its legal status and susceptibility to private ownership be made. (Kelly-Florida)
W70-00782

THE UNITED NATIONS AND MARINE RESOURCES,
For primary bibliographic entry see Field 06B.
W70-00783

PUBLIC RIGHT AND THE RULE OF NO COMPENSATION,
For primary bibliographic entry see Field 04A.
W70-00785

OIL POLLUTION OF THE SEA.
For primary bibliographic entry see Field 05G.
W70-00786

OIL POLLUTION AND THE SEA: THE SOURCES OF POLLUTION.
For primary bibliographic entry see Field 05B.
W70-00787

COMMISSIONERS OF HEALTH AND DRAINAGE IN CERTAIN COUNTIES.
For primary bibliographic entry see Field 04A.
W70-00788

OIL POLLUTION OF THE SEA: THE EFFECTS OF POLLUTION.
For primary bibliographic entry see Field 05C.
W70-00789

OIL POLLUTION OF THE SEA: THE INTERNATIONAL RESPONSE.
For primary bibliographic entry see Field 05G.
W70-00790

OIL POLLUTION OF THE SEA: THE INTERGOVERNMENTAL MARITIME CONSULTATIVE ORGANIZATION.
For primary bibliographic entry see Field 05G
W70-00791

OIL POLLUTION OF THE SEA: UNITED STATES ACTION.
For primary bibliographic entry see Field 05G.
W70-00792

OIL POLLUTION OF THE SEA: PRIVATE REMEDIES.
For primary bibliographic entry see Field 05G.
W70-00793

OIL POLLUTION OF THE SEA: THE EFFORTS OF THE OIL AND SHIPPING INDUSTRIES.
For primary bibliographic entry see Field 05G.
W70-00794

OIL POLLUTION OF THE SEA: DETECTION.
For primary bibliographic entry see Field 05A.
W70-00795

OIL POLLUTION OF THE SEA: CLEANING UP.
For primary bibliographic entry see Field 05D.
W70-00796

RIPARIAN RIGHTS IN ARTIFICIAL LAKES AND STREAMS,
For primary bibliographic entry see Field 04A.
W70-00797

NAVIGABLE WATERS--RIGHT OF RIPARIAN OWNER TO ARTIFICIAL ACCRETION,
For primary bibliographic entry see Field 04A.
W70-00798

COMMON LAW RIGHTS TO SURFACE WATERS,
For primary bibliographic entry see Field 04A.
W70-00799

STATUTES-EXTENT OF THE AUTHORITY OF THE DEPARTMENT OF CONSERVATION.
For primary bibliographic entry see Field 04A.
W70-00800

CONSTITUTIONAL LAW-NAVIGABLE WATERS-EXTENSION OF THE FEDERAL PREROGATIVE,
For primary bibliographic entry see Field 04A.
W70-00801

WATERS AND WATERCOURSES - EASEMENTS - IMPLIED DEDICATION OF FLOWAGE EASEMENT APPURTENANT TO A DAM,
For primary bibliographic entry see Field 04A.
W70-00802

RIPARIAN RIGHTS - RIGHT TO FOLLOW ACCRETIONS ACROSS FIXED BOUNDARY LINE.
For primary bibliographic entry see Field 04A.
W70-00803

EQUAL FOOTING AND THE MARGINAL SEA,
For primary bibliographic entry see Field 04A.
W70-00804

FRONTIER TOWN PROPERTIES, INC V STATE (CONDEMNATION VALUE OF WATER USE).
For primary bibliographic entry see Field 06C.
W70-00805

WATER POLLUTION CONTROL ACT.
For primary bibliographic entry see Field 05G.
W70-00806

HUNTING AND FISHING LICENSES.

W Va Code Ann, secs 20-2-42, 20-2-43, 20-2-44b, 20-2-48, 20-2-53, 20-2-56 (1966).

Descriptors: *West Virginia, *Permits, *Fishing, *Classification, Legislation, Legal aspects, Ohio River, Hunting, Streams, Regulation, National forests, Wildlife management, Frogs, Turtles, Aquatic life, Ponds, Riparian rights, Impoundments, Administrative agencies, Natural resources, Fish reproduction, Federal government, Wildlife conservation, Commercial fishing.
Identifiers: *State parks.

Fishing licenses are required for residents and nonresidents, and special licenses are required to fish in state parks. The state department of natural resources will cooperate with the United States forest service to improve wildlife resources. Licenses may be issued for the operation of private ponds or businesses for the propagation, sale, or purchase of forms of aquatic life for commercial purposes; the activities of such licensees is regulated by the director to insure against violation of riparian rights of others and detrimental effects on natural resources. Licenses may be similarly issued for the operation of commercial fishing ponds. (Keith-Florida)
W70-00807

CERTAIN FERRIES OPERATED BY CONNECTICUT.

Conn Gen Stat Ann sec 13a-252 (1958).

Descriptors: *Connecticut, *Ships, Administration, Transportation, Income, Costs, Administrative agencies, Operation and maintenance, Operating costs, State governments.
Identifiers: *Ferries.

Two state-run ferries crossing the Connecticut River are maintained and operated by the highway commissioner. He, with the approval of the Commissioner of Finance and Control, determines the tolls to be charged and deposits the receipts with the state Treasurer. Operating expenses are paid by the Controller on vouchers of the Highway Commissioner. The Commissioner must also make a report to the general assembly on the receipts and expenses incidental to the operation of the ferries. (Gabrielson-Florida)
W70-00808

COMMISSIONERS OF STEAMSHIP TERMINALS.

Conn Gen Stat Ann secs 15-27 thru 15-31 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Transportation, *Bridge construction, *Navigable waters, Legislation, Legal aspects, Administrative agencies, Cities, Construction, Maintenance, Docks, Piers, Dikes, Canals, Jurisdiction, Maps, Surveys, Rivers, Harbors, Banks, Erosion, Easement, Riparian rights, Permits, Structures, Costs, Watersheds (Basins), Civil engineering, Ships, Financing, Transportation control, Federal government, Regulation, Control.
Identifiers: *Steamship terminals, *Harbor improvement, Harbor facilities, Obstructions to navigation, Penalties (Criminal).

Provision is made for the method of appointment of commissioners of steamship terminals; their length of service and the professions from which they may be chosen are stipulated. The commissioners may acquire, construct, maintain and operate such docks, wharves, piers, quays, dikes, canals, slips, basins, terminals, or other appropriate harbor facilities, and water transportation facilities in specified cities as are required to promote the in-

terchange of rail and water traffic. The commissioners consult and cooperate with the federal authorities regarding any river or harbor improvement or the construction of any bridge over navigable waters within the state. The commissioners may cause surveys to be made of navigable waters or extensions thereof, of waters that may be made navigable, or for the protection of river banks against erosion. The commissioners confer with cities concerning water terminal facilities and promote greater coordination between water and rail transportation. The commissioners are charged with conservation and development of water transportation. The commissioners may sell such lands, easements, riparian rights, and other property as may be acquired by them; the disposition of proceeds from such sales and from operations is provided for. Persons obstructing navigation in specified ways are subject to criminal penalties. (Keith-Florida)
W70-00809

POTOMAC RIVER COMPACT OF 1958.

Md Ann Code Art 66C sec 261 A (1957).

Descriptors: *Maryland, *Interstate compacts, *Fish management, *Fisheries, Virginia, Legislation, Regulation, Ownership of beds, Low water mark, Riparian rights, Oysters, Clams, Shellfish, Crabs, Fish conservation, Water resources development, Permits, Docks, Administrative agencies.
Identifiers: Penalties, Finfish.

The Potomac River Compact of 1958 between Virginia and Maryland is agreed to by the commissioners appointed by the respective states. The Potomac River Fisheries Commission is established. Regulations for compensation, meetings, offices, and employees are set forth. The Commission's jurisdictional boundaries are delineated. The Commission has the power to survey oyster bars within its jurisdiction. It may reseed and replant said bars. The size, type, and description of all species of finfish, crabs, oysters, clams, and other shellfish which may be taken are conservation and repletion of fishery resources. Licenses may be issued for fishing and for equipment to be used within the Commission's territory. Other Commission powers and duties regarding expenditures, regulations, inspection tax, and the dredging of soft-shell clams are set forth. Regulations for procedure and review of Commission regulations are set forth. Penalties are provided for violations of these regulations. Rights of citizens of Virginia and Maryland to erect and maintain wharves and other improvements are not altered or diminished. Laws of Maryland relating to finfish, crabs, oysters, and clams in the Potomac River remain applicable except when changed by Commission regulation. (Moulder-Florida)
W70-00810

NATURAL RESOURCES (OYSTERS AND CLAMS).

Md Ann Code Art 66C secs 696, 698 thru 704, 707, 708, 709, 710, 712 thru 717 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Clams, *Oysters, *Commercial shellfish, Legislation, Regulation, Administration, Mollusks, Dredging, Fishing, Permits, Industries, Commercial fishing, Fishing gear, Conservation, Public benefits, Management, Hydraulic equipment, State jurisdiction, Legal aspects.
Identifiers: Penalties.

Regulations pertaining to the taking of oysters and clams are set forth. Basic definitions, geographical areas and other general provisions applicable to the industry are included. Provisions covering the culling of oysters, tonging, licensing fees and requirements, restricted areas, and certain exceptions are set forth. Dredging restrictions, including land area, boat and dredge size, and licensing requirements together with special provisions for dredging in county waters are provided. The Potomac River fisheries are reserved for residents of Virginia and Maryland. Oyster packers and dealers are regulated in line with legislative provisions for propagation of oyster culture, including private oyster culture. Areas to be leased, who may lease, procedures for obtaining a lease, the type of oyster that may be harvested and fees are provided. Taxing and licensing provisions relating to the oyster and clam industry are provided. Soft-shell clam regulations are promulgated for specific counties. (Moulder-Florida)
W70-00811

SHOREFRONT PARK IMPROVEMENT ASSOCIATION, INC V KING (RIPARIAN RIGHTS AND RESTRICTIONS ON THE RIPARIAN LAND).

253 A2d 29-34 (Conn 1968).

Descriptors: *Connecticut, *Riparian rights, *High water mark, *Low water mark, Legal aspects, Judicial decisions, Marinas, Navigable waters, Water law, Boundaries (Property), Piers, Leases, Docks, Riparian land, Ownership of beds, Competing uses, Recreation, Relative rights, Riparian waters.
Identifiers: *Restrictive covenants, *Subdivisions, *Intent, Yacht clubs, Reciprocal rights, Moorings, Injunctions (Prohibitory).

Plaintiffs are homeowners in a subdivision in which lots are sold with restrictive covenants in the deeds; the restrictive covenants are of a type commonly used to keep an area residential in nature. Defendant corporation leased several lots within the subdivision for use as a yacht club and marina. The Superior Court granted plaintiff's plea for injunctive relief and the defendant appealed. The Supreme Court first found that the proposed use of lots within the subdivision for business purposes would be in direct violation of the covenants. The Supreme Court then noted that the title to land between high and low water marks is in the state; this being the case, such rights as the defendant has to build docks and piers below the high water mark are riparian rights which have their source in the property ownership of the land above the high water mark. It follows that defendant's riparian rights are subject to the restrictive covenants; the decision of the Superior Court was affirmed. (Keith-Florida)
W70-00812

PIERCE V RILEY (UNREASONABLE EXTENSION OF RIPARIAN RIGHTS).

168 NW2d 309-311 (Ct App Mich 1969).

Descriptors: *Michigan, *Riparian rights, *Easements, Right-of-way, Riparian land, Access routes, Lakes, Lake shores, Non-consumptive use, Recreation, Water rights, Legal aspects, Judicial decisions, Remedies, Water utilization.
Identifiers: Injunctions (Prohibitory).

Plaintiffs, riparian property owners, filed suit for a declaration of rights and to enjoin defendant real estate developers from granting easements of right-of-way to non-riparian lot owners. Defendants owned 91 lots, one of which fronted on the lake. Defendants proposed to sell the lots and provide all lot owners with access to the lake by granting easements of right-of-way across their lake front lot. Plaintiffs contended that this would constitute an extension of use and riparian rights that would result in an unreasonable burden on other riparian owners. After a hearing, the trial court found in favor of defendants, and plaintiffs appealed. The appellate court found that an injunction was a proper method through which plaintiffs could seek to protect their property rights. The court remanded the case for reconsideration of the reasonableness of the use in light of the factors set forth in Thompson v Enz, 154, NW2d 473, with both parties being given the right to present additional evidence as to the reasonableness of the factors not pleaded. (Gabrielson-Florida)
W70-00813

CANALS AND WATERWAYS.
For primary bibliographic entry see Field 04A.
W70-00814

ILLINOIS DRAINAGE LAW (A COMMENTARY).
Illinois State Bar Association.
For primary bibliographic entry see Field 04A.
W70-00815

PUBLIC UTILITIES (PUBLIC WATER DISTRICTS).

Ill Ann Stat ch 111 2/3, secs 188-212.10 (Smith-Hurd 1966), as amended, (Supp 1969).

Descriptors: *Illinois, *Water districts, *Water works, *Public benefits, Legislation, Administration, Regulation, Utilities, Water distribution (Applied), Water rates, Water supply, Public health, Public utility districts, Sewage treatment, Sanitary engineering, Rates, Financing, Capital, Operation and maintenance, Condemnation, Administrative agencies.

The creation of public water districts by election is authorized. Such water districts are managed by a board of seven trustees which act as the corporate authority of the district. Attorneys and engineers may be appointed. Land condemnation proceedings are authorized. The districts are authorized to construct, maintain, and extend water mains where necessary. The districts may contract to supply water outside the district. The boards of trustees may maintain, operate, and improve water works properties within districts in which the boards consider such action conducive to public health. The boards establish rates and charges. Revenue bonds may be issued. The districts may construct water works within villages or towns not owning or operating water works systems. The districts have the power to acquire, maintain, and operate sewerage properties and may issue revenue bonds for this purpose. Contiguous territory may be annexed by the water districts. Procedures are outlined for the annexation and dissolution of districts. (Moulder-Florida)
W70-00816

ISLANDS AND ABANDONED RIVER CHANNELS.
For primary bibliographic entry see Field 04A.
W70-00817

LEVEES.
For primary bibliographic entry see Field 04A.
W70-00818

LEVEES.
For primary bibliographic entry see Field 04A.
W70-00819

LEVEES.
Ky Rev Stat Ann secs 266.120-266.990 (1963).

Descriptors: *Levees, *Kentucky, *Construction, *Administrative agencies, Legislation, Eminent domain, Engineering structures, Local governments, Adjudication procedure, Administrative decisions, Easements, Equitable apportionment, Judicial decisions, Compensation, Construction costs, Assessments loans, Taxes, Maintenance costs, Decision making, Operation and maintenance.

The board of levee commissioners shall superintend the construction, care, and protection of the levee. They may enter upon, acquire, take and hold

any lands necessary and proper for locating, constructing, enlarging, and maintaining the levee. In order to carry out their duties, the board may: (1) enter into agreements with any commission or agency of the federal government; (2) levy and collect an annual tax on property within the territory protected by the levee; (3) borrow needed funds and issue, negotiate and sell bonds for this purpose; and (4) make additional assessments under drainage law procedure to meet needed expenses. A lien for the costs of the levee shall exist against all land within the territory protected by the levee. When it will be conducive to the public welfare or benefit, any county court may establish and aid in the construction of any levee within the county. Provisions for fining violators of the provisions of this chapter are outlined. (Schram-Florida)
W70-00820

DRAINAGE AND RECLAMATION ACT OF 1912.
For primary bibliographic entry see Field 04A.
W70-00821

DRAINAGE AND RECLAMATION ACT OF 1912.
For primary bibliographic entry see Field 04A.
W70-00822

DRAINAGE AND RECLAMATION ACT OF 1912.
For primary bibliographic entry see Field 04A.
W70-00823

DRAINAGE AND RECLAMATION ACT OF 1912.
For primary bibliographic entry see Field 04A.
W70-00824

DRAINAGE AND RECLAMATION ACT OF 1912.
For primary bibliographic entry see Field 04A.
W70-00825

OHIO RIVER VALLEY WATER SANITATION COMPACT.
For primary bibliographic entry see Field 05G.
W70-00826

FLOOD CONTROL ACT.
For primary bibliographic entry see Field 04A.
W70-00827

FLOOD CONTROL ACT.
For primary bibliographic entry see Field 04A.
W70-00828

FLOOD CONTROL ACT.
For primary bibliographic entry see Field 04A.
W70-00829

INTERSTATE DRAINS.
For primary bibliographic entry see Field 04A.
W70-00830

FISH NOT TO BE KILLED OR TAKEN BY EXPLOSIVES.
Miss Code Ann sec 2158 (1956).

Descriptors: *Mississippi, *Fish, *Fish conservation, *Explosives, Legislation, Standards, Fish management, Fishing, Wildlife conservation, Wildlife management, Legal aspects, Regulation.
Identifiers: *Dynamite fishing, Fishing with explosives, Penalties (Criminal).

Any person who catches or destroys fish by the use of dynamite, gunpowder, or other explosive substance shall, on conviction, be fined not less than one hundred dollars and/or be imprisoned in the county jail not exceeding three months. (Schram-Florida)
W70-00831

DRAINAGE OF WATER FROM PUBLIC ROADS; AND REPAIR OF FLOOD DAMAGE TO CERTAIN ROADS.

Miss Code Ann sec 8317, 8328-32 (1956).

Descriptors: *Mississippi, *Highways, *Drainage, *Flood damage, Surface drainage, Drainage engineering, Drainage practices, Surface waters, Bridges, Surface runoff, Drainage water, Flooding, Damages, Repairing, Maintenance, Legal aspects, Legislation, Planning.

The board of supervisors is authorized to drain water from public roads, through and over adjacent lands. Damages may be allowed to adjacent landowners. The Highway Commission is empowered to repair roadbed, surfacing and bridges being constructed as 'farm-to-market' projects, in accordance with provisions of the County Highway Aid Act of 1946. No provision was made in that act for repair of damage to roadbeds and bridges caused by excessive floods after construction but before final acceptance, and that omission is hereby remedied. (Kelly-Florida)
W70-00832

BRIDGES - GENERAL PROVISIONS.
For primary bibliographic entry see Field 04A.
W70-00833

MUSSELS.
Miss Code Ann secs 5913-5922 (1952).

Descriptors: *Mussels, *Permits, *Regulation, *Mississippi, Fishing gear, Freshwater, Aquatic animals, Legislation, Shellfish, Commercial shellfish, Wildlife conservation, Wildlife management, Fish conservation, Fish management, Fish, Administrative agencies, Legal aspects.
Identifiers: Mussel flats, Penalties (Criminal).

Ownership of all mussels found in fresh water is vested in the state. It shall be unlawful to take mussels without first obtaining a license. Mussels taken under three inches in length shall be returned to the water. If the mussels taken are to be used for scientific purposes, a permit must be obtained from the Director of Conservation. Anyone violating this act shall be guilty of a misdemeanor. (Darragh-Florida)
W70-00834

STREAM POLLUTION.
For primary bibliographic entry see Field 05G.
W70-00835

6F. Nonstructural Alternatives

ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES BY DIGITAL COMPUTER,
Kentucky Univ., Lexington.
For primary bibliographic entry see Field 06A.
W70-00617

OPERATIONAL PROCEDURES FOR EVALUATING FLOOD PROTECTION BENEFITS,
Department of Agriculture, Washington, D.C.; and North Carolina State Univ., Raleigh.
R. A. Freund, and G. S. Tolley.
IN Economics and Public Policy in Water Resource Development, Ames, Iowa State University Press, p 150-170, 1964. 21 p, 1 fig, 9 tab, 4 ref. Edited by S. C. Smith, and E. N. Castle.

Descriptors: *Watersheds, *Economic analysis, *Economic evaluation, Planning, Floodwater, Benefits, Floodplain, Coastal plains, Income, Costs, Measurement, Crops, Streams, Hydrology, Data collection.
Identifiers: *Workplan, Tobacco, Cropland.

This article deals with a project write-up which presents alternative lines of development in floodplain agriculture. It is oriented to small watershed projects, since planning for these is similar to planning for larger projects, and is thus relevant to other water resource programs. As a result, a case can be made for adoption as a package of the modified workplan and a shortened evaluation method in watershed projects. The workplan calls for expanded economic content which recognizes that benefits cannot be predicted with certainty, and describes the alternative possible outcomes. The shortened evaluation method presents a less refined method of application which frees the economist for more extended work on the workplan. This plan enables economists to remain cognizant of trends affecting regional agriculture and the watershed planning. (Murphy-Rutgers)
W70-00625

THE RELATIONSHIP BETWEEN FLOOD LOSSES AND FLOOD-CONTROL BENEFITS,
Chicago Univ., Ill.
For primary bibliographic entry see Field 06C.
W70-00628

FLOOD CONTROL POLICY AND FLOOD MANAGEMENT,
William Whipple, Jr.
New Jersey Water Resources Research Institute Report, Rutgers University, New Brunswick, New Jersey. Paper presented at Interstate Conference on Water Problems, Oct 17-18, 1968. 14 p.

Descriptors: *Flood control, *Flood plain management, *Non-structural alternative, *Flood plain insurance, *Flood plain zoning, Flood protection, Flood damage.
Identifiers: *Project-induced economic growth, Flood plain encroachment.

Total annual flood damages are increasing, due to encroachment upon flood plains. Reservoir flood control if often illusory, as project-induced growth recreates flood hazards. The Federal Flood Insurance Act of 1968 was advocated to control flood plain occupancy; but since it is both voluntary and subsidized it may actually increase flood plain occupancy. This flood insurance is essentially a financial palliative rather than a non-structural alternative. Zoning remains the essential alternative to structural flood control. Flood insurance may provide an incentive to zoning by the states if properly administered.
W70-00728

OPTIMUM INESTMENT IN STRUCTURAL FLOOD CONTROL,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W70-00729

COORDINATION OF URBAN PLANNING AND FLOOD PLAIN DEVELOPMENT,
For primary bibliographic entry see Field 06B.
W70-00751

THE INTERACTION OF URBAN REDEVELOPMENT AND FLOOD PLAIN MANAGEMENT IN WATERLOO, IOWA,
For primary bibliographic entry see Field 06B.
W70-00752

6G. Ecologic Impact of Water Development

LAND USE ALONG A TROPICAL CLIMATIC BOUNDARY: THE WALAWE GANGA BASIN OF CEYLON,
National Academy of Sciences-National Research Council, Washington, D.C.
For primary bibliographic entry see Field 03B.
W70-00463

PERSPECTIVES ON ENVIRONMENTAL PLANNING AND RESOURCE DEVELOPMENT,
Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 06B.
W70-00510

AN ENVIRONMENT FIT FOR PEOPLE,
Raymond F. Dasmann.
New York Public Affairs Committee, 1968. 28 p.

Descriptors: *Environment, *Conservation, Technology, Population, Wildlife, Ecology, Environment, Cities, Air pollution, Water pollution, Solid wastes, City planning, Soil erosion.
Identifiers: Urban space, Rural lands, Rangelands, Forest conservation, Marine environment.

We have made spectacular gains in our method for producing the needs and luxuries of life. But technological advances are being bought at the cost of increasing deterioration of the environment, pollution of air and water, crowding and congestion, loss of living space and destruction of natural environments. There is worry that even if man's material needs can be satisfied, the world he lives in will be less suited to maintaining those human qualities that make men fit company for one another. A concern for keeping the world a fit place for people is the basis for the social movement known as conservation. Like the environment, the meaning of conservation has been changing. The conservationist was once involved mostly with the natural world and the rural scene. Today the conservationist is also concerned with the concentration of population in towns and cities, the dangers of pollution, the population explosion, etc. Many of these areas of interest, such as in water pollution, have economic ramifications which must be considered by the conservationist. (Loeb-Rutgers)
W70-00603

NATURAL RESOURCES: QUALITY AND QUANTITY.

California, Berkeley and Los Angeles, University of California Press, 1967. 217 p. Edited by Ciriacy-Wantrup, S. V. and Parsons, James J.

Descriptors: *Natural resources, Quality control, Water quality, Value, Management, Land, Burning, Mineralogy, Public health, Air pollution, Wildlife management, Ecosystems, Administration, Planning.
Identifiers: *Quality, *Quantity, Interdisciplinary areas, Identification, Social systems, Air quality management, Public policy.

The essays composing this volume were first presented before an interdisciplinary faculty seminar at the University of California, Berkeley. The seminar was sponsored by the Chancellor's Committee on Natural Resources. The main concerns of the Committee were the effects of specialization and of an academic structure based on disciplines upon the advancement of interdisciplinary areas of study. The seminar was also to explore the possibilities for organizing interdisciplinary research on natural resources into an Institute of Natural Resources. The central theme of this volume concerns the problems of environmental quality and the relations between quality and quantity in the natural resources area. The three essays of Part I deal with the issue of identification. The difficulties of identifying the dimensions of quality are of a different order of magnitude from those involved in identifying the dimensions of quality are of a different order of magnitude from those involved in identifying the dimensions of water quality. The difference is that evaluation is involved. The seven essays of Part II are concerned with the type of quality dimensions illustrated by water quality. The essays of Part III deal with complex biological-social systems dominated by the two great evolutionary forces of mutation and selection. (See also W70-00606 thru W70-00612). (Loeb-Rutgers)
W70-00605

QUALITY IN THE CONTROL OF QUANTITY,
California Univ., Berkeley.
Lewis Mumford.
Natural Resources: Quality and Quantity, p 7-18, University of California Press, Berkeley and Los Angeles, 1967. 12 p.

Descriptors: Technology.
Identifiers: *Quality, *Quantity, Technological innovation, Science, Workmanship, Standardization, Mass production, Quantification.

The author contends that the problem of our age, which dominates or underlies most of its other problems is the problem of quality. The evidence increasingly shows that many technological innovations that have been regarded as indications of progress have actually been regressive in their effects, in that they have favored mechanical processes at the expense of human functions and human purposes. The author exposes the ideological misconceptions that have impelled us to promote the quantative expansion of knowledge, power and productivity, without inventing any adequate system of controls. The author further proposes to show that the deliberate disregard of qualities in the conceptual scheme of seventeenth century science has removed the complex, built-in controls which, though sometimes clumsy, had hitherto been effective. The idea might be useful in the water area in studies pertaining to water pollution and the quality of outdoor recreation associated with water resources. (See W70-00605). (Loeb-Rutgers)
W70-00606

RESOURCE QUALITY AND VALUE OF THE LANDSCAPE,
California Univ., Berkeley.
D. B. Luten.
Natural Resources: Quality and Quantity, p 19-34, University of California Press, Berkeley and Los Angeles, 1967. 16 p, 4 fig.

Descriptors: *Value, Natural resources, Water quality, Water management, Systematics, Boundaries, Ecosystems.
Identifiers: *Resource quality, *Landscape wilderness.

When we speak of the 'quality' of a natural resource at least two aspects may come to mind. The first is well symbolized by water. The 'quality' of water is often an issue in the management of water, but it can usually be measured in terms of the quantity of impurities. While the qualitative epithets 'good' or 'bad' may be applied to it, they always lead to the queries, 'How good,' 'How bad,' and these answers must be made in quantitative terms. In sharp contrast to this is the second aspect which compares the quality of a particular good relative to another. Two topics are examined in this essay. The first pertains to the divisions and boundaries within a discipline. Discipline divisions are usually separated by boundaries which indicate qualitative changes. For example, we might be interested in the division or border between soft and hard water, or between water of different degrees of purity. The final discussion in this article is an argument to justify the landscape itself especially the wilderness landscape, as a natural resource. The author contends that the wilderness is perhaps the most important of all resources, both in quality and quantity, because it is essential for the long-range welfare of men. Many economic studies in the water area are involved with the preservation of these natural resources and the improvement of the quality of them as well. (See W70-00605). (Loeb-Rutgers)
W70-00607

PROBLEMS OF QUALITY AND QUANTITY IN THE MANAGEMENT OF THE LIVING RESOURCES OF THE SEA,
California Univ., San Diego, La Jolla.
Milner B. Schaefer.
Natural Resources: Quality and Quantity, p 87-101, University of California Press, Berkeley and Los Angeles, 1967. 15 p, 3 fig, 11 ref.

Descriptors: *Water resources, *Foods, *Recreation, Sea water, Prices, Fisheries, California, Planning.
Identifiers: International considerations, Management problems, Marine resources, Quantity, Quality.

The primary use of the living resources of the sea is for protein food for direct human consumption. However, particularly important in the United States, and especially in California, is the use of the living resources of the sea for recreation. The pursuit of game fish species, such as tunas, marlin, yellowtail, bonito, flounders, and shore fish is enjoyed by large numbers of our citizens. A not negligible use of the sea's living resources is for the utility people derive from observing the larger animals in their natural habitat. A crude measurement of the quantity of the harvest of the sea is provided by the weight of the landed catch. The measurement of quality is a great deal more difficult, since quality depends not only on the inherent properties of an object but also on the attitude of the user. For organisms harvested commercially for human food, price is probably the most useful comparative measure of quality. Recreational uses depend very greatly on quality, but the quality of a recreational resource is difficult to measure. The author states, therefore, that it is probably useless to attempt to categorize the recreational resources with respect to quality. The article further discusses international considerations in the management of the living resources of the sea as well as the growth and potential of the world's fisheries, management problems and techniques and a marine resources planning study. (See W70-00605). (Loeb-Rutgers)
W70-00608

THE ECOSYSTEM AS A CONCEPTUAL TOOL IN THE MANAGEMENT OF NATURAL RESOURCES,
California Univ., Berkeley.
Arnold M. Schultz.
Natural Resources: Quality and Quantity, p 139-161, University of California Press, Berkeley and Los Angeles, 1967. 23 p.

Descriptors: *Ecosystems, *Natural resources, Ecology, Economics, Environment, Population, Organizations, Trophic level, Energy, Entropy, Stability, Land management.
Identifiers: *Resource management, Integrative levels, Mineral cycling, Steady state, Diversity, Capacity, Homeostasis, Park management.

Despite their connate derivation, ecology and economics are usually thought of as having little in common. One reason for this is the equivocal role assigned to man by ecologists compared with the assignment made by economists. The term 'natural' implies that there is no effective disturbance by man. Man excludes himself from nature, as he chooses. When his positive relations to the environment are stressed, the specialized term 'human ecology' is employed. In contrast, the term 'resource' carries the implication of a planning agent, a manager with a goal. Here man, individually or as

one of his social groupings, appraises the usefulness of his environment; in this role he makes decisions on whether or not and how to make effective disturbances in nature. A useful concept, recently developed, reaffirms the close connections between the two eco-sciences. This concept is called the ecosystem--a functional unit conveniently organized to study the general activities of production, distribution, exchange, and consumption. It might easily be applied to the water area since in this area man is virtually concerned with his positive relation to the environment so as to effect the production, distribution, exchange and consumption of various attributes of this sector. The main objective of the author is to show that it is logical to consider the manageable unit of human, cultural, and natural resources as an ecosystem. There are two secondary objectives. One is to straighten out the sometimes bewildering distinction between ecosystem and community. The other is to make a case for ecosystem study as a separate science. The important economic and ecological role of water makes this article relevant to the water researcher. (See W70-00605). (Loeb-Rutgers)
W70-00609

THE QUEST FOR QUALITY IN THE ADMINISTRATION OF RESOURCES,
California Univ., Berkeley.
Albert Lepawsky.
Natural Resources: Quality and Quantity, p 162-175, University of California Press, Berkeley and Los Angeles, 1967. 14 p.

Descriptors: *Administration, Mathematical studies, Natural resources, Benefits, Costs, Conservation, Cost-benefit analysis.
Identifiers: *Resources quality, *Quantification, Quantity, Quality, Policy formulation.

In the analysis and administration of natural resources, there is a tendency to counterpoise the attributes of quantity to those of quality. Some resource economists have even hypothesized an inverse relation between quantity and quality. Other resource scientists and most resource conservationists actually decry this sort of mathematical syndrome in modern mass society. They argue that the overemphasis upon quantity and quantification subordinates and depreciates the quality and character of resources and resource uses and deflects from the quest for values and standards. The growing concern for quality in the administration of natural resources arises in part from the new role of unconventional resources such as recreational amenities or space, where standards of measurement and criteria of evaluation lack precision. The search for quality is also a consequence of the sheer pressure upon resources of human numbers and needs, to a point where existing ways of living are either threatened or actually being qualitatively transformed. The paper discusses the potentialities of quantitative techniques as applied to resource administration and policy formulation. Such possible potentialities would be of value in the water area. (See W70-00605). (Loeb-Rutgers)
W70-00610

ON SOME MEANINGS OF 'PLANNING',
California Univ., Berkeley.
William Peterson.
Natural Resources: Quality and Quantity, p 176-196, University of California Press, Berkeley and Los Angeles, 1967. 21 p.

Descriptors: *Planning, Economics.
Identifiers: Five-year plan, Deductive planning, Marx, Engels, Socialism, Capitalism, Utopian planning, Inductive planning.

More and more of the social processes of the twentieth-century world are 'planned.' Five-year plans, once restricted to the Soviet Union, have spread not only to other Communist states but to such diverse countries as India and Brazil. In the United States the whole social-economic structure was altered by the government's response to the depression of the 1930's and to World War II. City planners have extended their purview to regions and then, through local, national, or international agencies, to the whole physical-social environment of human life. Planning has also extended its reach into the water area and the importance of water resources to planned development, particularly on a regional level, makes this article of interest to the water researcher. (See W70-00605). (Loeb-Rutgers)
W70-00611

PRESSURES OF GROWTH UPON ENVIRONMENT,
Washington Univ., St. Louis, Mo.
Harold J. Barnett.
Environmental Quality in a Growing Economy, Baltimore, Johns Hopkins Press, p 15-20, 1966. 6 p, 2 ref. Edited by H. Jarrett,

Descriptors: *Growth rates, *Environment, *Ecology, *Market value, *Decision making, Population, Shrinkage, Climates, Land, Income, Market value, Rent, Floods, Erosion, Landscaping, Value, Natural resources.
Identifiers: *Econosphere, *Congestion, *Economic history, Society, System, Synthetics, Laissez-faire, Free enterprise, Yield, Benefit-cost measurement.

This article proposes that a great increase in the size of the human ecology system will bring differences in both the nature and character of that system. At times when these tendencies have appeared, there has been a growth in perception of and discomfort from environmental congestion and damage, at which point the whole populace appears to want better quality in its environment. In the economic theory of a free enterprise economy, there is no necessary reason why due process appropriation of economic rent or land titles should interfere with classical economic efficiency nor why democratic decisions to place boundaries and rules on land use might not improve economic welfare. This article suggests that Presidential and Administration decisions to improve the quality of the environment are imminent and economic analysis should play a major role in determining the composition of these expenditures. Since water resources are a vital part of the changing environment, this article is of interest to the water resource planner. (Murphy-Rutgers)
W70-00618

THE SONORAN DESERT; ITS GEOGRAPHY, ECONOMY, AND PEOPLE,
Roger Dunbier.
University of Arizona Press, Tucson, 1968. 426 p.

Descriptors: *Water resources development, *Economy, *Social aspects, Deserts, Arid lands, Mexico, Southwest U.S., Arizona, Vegetation, Soils, Climates, History, Colorado River Basin.
Identifiers: *Sonoran Desert, Sonora, Salt River Valley (Ariz).

A regional geography that treats the economic development of the Sonoran Desert of North America. Chapters include; The Desert and Desert Landforms, Climate, Soils, Vegetation, Water, Social Evolution, The Mission Period, Westward Crossings, Water Resource Development, The Native Economy, The Mexican Economy, The American Economy, Political Factors, and A Pattern of Settlement. The water chapter reviews natural occurring waters. Areas of internal drainage and desert streams are treated along with floods and groundwater. Streams that originate outside the desert are considered by geographical subunits. The various aspects of water resources development in this area are treated under the general heading of Development of Groundwater, Lower Colorado Valley, Salt River Valley, Other Arizona Districts, and Development of Water Resources in Mexico. The overriding importance of water in the social, cultural and economic development of this desert is emphasized throughout. (Sherbrooke-Arizona)
W70-00700

THE FOREST VEGETATION OF THE BRULE RIVER BASIN, WISCONSIN, TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior.
For primary bibliographic entry see Field 02I.
W70-00765

07. RESOURCES DATA

7A. Network Design

SOME METEOROLOGICAL REQUIREMENTS IN WATERSHED ENGINEERING RESEARCH,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
David M. Hershfield.
Proc 3rd Annu Amer Water Resources Conf, Nov 8-10, 1967, San Francisco, Calif, p 485-492, 1967. 8 p, 4 fig, 4 ref.

Descriptors: *Meteorological data, *Surveys, *Network design, Data collections, Watershed management, Rainfall, Runoff, Rainfall-runoff relationships, Duration curves, Depth-area curves, Depth-area-duration analysis, Distribution patterns, Rainfall disposition, Evapotranspiration.
Identifiers: Watershed engineering, Data requirements.

The major meteorological needs in the hydrologic phase of watershed engineering are for good estimates of various characteristics of precipitation and evapotranspiration. For precipitation this includes storm volume, depth-area relationship, time distribution, and the storm progression pattern. Only the first of these characteristics can be reliably estimated in well-instrumented research watersheds in most parts of the country. Similarly, estimates of several characteristics of evapotranspiration are required, foremost of which is areal estimates for short durations of time. This is one of the major problem areas in watershed research. (Knapp-USGS)
W70-00474

RADAR-COMPUTED RAINFALL COMPARED WITH OBSERVATIONS FROM A DENSE NETWORK OF RAIN GAUGES,
Environmental Technical Applications Center (Air Force), Washington, D.C.
Martin Ross.
USAF, Air Weather Service, ETAC Technical Note 69-4 June 1969. 11 p, 1 tab, 3 fig, 3 ref. Available from the Clearinghouse as USAF ETAC TN 69-4, $3.00 in paper copy, $0.65 in microfiche. AD-688 434.

Descriptors: *Radar-computed rainfall, *Rainfall intensity, Rainfall.
Identifiers: Precipitation.

Using Wilson's Rainfall Rate - Echo Intensity (RR-EI) chart, based on the average relationship, radar data collected for 36 hours, using the US Weather Bureau's WSR-57 at Atlantic City, New Jersey, are compared with rainfall data from three tipping-bucket rain gauges. These tipping-bucket gauges are located within 60 nm of the radar and cover a 4.8 square-mile area. Comparisons between the radar and tipping-bucket gauges are shown. Radar measurements were within 2% of the total rain gauge average. The correlation coefficient was .91. Use of the US Weather Bureau's RR-EI chart would have underestimated the average areal precipitation. Hourly rainfall amounts of 0.01 inches were detected in 80% of the cases. Hourly amounts of 0.02 inches or more were detected in 100% of the cases.
W70-00483

HYDROLOGICAL REQUIREMENTS FOR WEATHER RADAR DATA,
For primary bibliographic entry see Field 02B.
W70-00673

7B. Data Acquisition

DIRECT ILLUSTRATION OF ONE WAY SAND TRANSPORT BY TIDAL CURRENTS,
National Inst. of Oceanography, Wormley (England).
For primary bibliographic entry see Field 02J.
W70-00436

A DIVERSIFIED PROGRAM FOR THE STUDY OF SHALLOW WATER SEARCHING AND MAPPING TECHNIQUES,
Pennsylvania Univ., Philadelphia. Univ. Museum.
George F. Bass, and Donald M. Rosencrantz.
Available from Clearinghouse as AD-686 487 for $3 in paper copy, 65 cents in microfiche. Final Rep of Univ Museum, Penn Univ, Nov 1968. 130 p, 32 fig. ONR Contract N00014-67A-0216-0002.

Descriptors: *Remote sensing, *Underwater, *Oceanography, *Mapping, *Instrumentation, Surveys, Data collections, Reviews, Photography, Submarines, Photogrammetry.
Identifiers: Sonar mapping.

The capabilities of two side looking sonar systems were evaluated in waters ranging from 250 to 350 ft. Detected targets were visually examined using underwater television and the ASHERAH submersible. Two ancient shipwrecks were discovered as a result. A stereophotogrammetric mapping system was designed, and tested on the ASHERAH. It was demonstrated that it is possible to map extended areas of the ocean's floor using overlap stereophotography without the need for surveyed ground control data. Various photographic techniques, submersible handling and logistic problems, and underwater viewing systems including viewpoint optics are also discussed. (Knapp-USGS)
W70-00461

AN EXPERIMENTAL IN SITU DENSITOMETER,
Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
Howard W. Kuenzler.
Available from Clearinghouse as AD 681 090 for $3 in paper copy, 65 cents in microfiche. Rep 68-3, Fluid Dynam Lab, Mass Inst Technol, Sept 1968. 56 p, 18 fig, 4 tab, 8 ref. ONR Contract NONR 1841 (74).

Descriptors: *Instrumentation, *Oceanography, *Water measurement, *Density, *Sea water, On-site tests, Calibrations, Electronic equipment, Measurement, Research equipment, Strain gages.
Identifiers: In situ densitometer (Water), Water density measurement.

A new prototype transducer capable of making direct measurements of fluid density in situ has been developed. The theory of design, the method of construction, and the performance in laboratory tests are discussed in view of its possible application as an oceanographic tool for precise measurement of seawater density. Present sensitivity is within an order of magnitude of the capabilities of indirect techniques currently being used for seawater. Suggestions are made for improving the precision, and indications are given that the device has potential as a sea-going oceanographic instrument. (Knapp-USGS)
W70-00462

OPTICAL OCEANOGRAPHY,
Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.
N. G. Jerlov.
Amsterdam, Elsevier Publishing Co, 1968. 194 p, 83 fig, 28 tab, 294 ref.

Descriptors: *Oceanography, *Sea water, *Optical properties, Light, Refractivity, Turbidity, Dispersion, Albedo, Solar radiation, Absorption, Bioluminescence, Instrumentation, Analytical techniques, Photosynthesis, Water pollution effects, Color.
Identifiers: *Optical oceanography.

Optical oceanography is defined, discussed in detail, and existing literature on the subject is reviewed in a comprehensive monograph. The properties of sea water, including light absorption, scattering, polarization, attenuation, albedo, refraction, radiation, color, and visibility are explained. Instrumentation, techniques of study, applications of optical methods, uses of research, and biological studies are discussed. Fundamental data for the study of photosynthesis are given. These include solar radiation, transparency, effect of particles on light scattering and absorption, bioluminescence, and water pollution effects. (Knapp-USGS)
W70-00464

TRACTIONABILITY STUDY FOR THE LAO-TIAN PANHANDLE,
Environmental Technical Applications Center (Air Force), Washington, D.C.
For primary bibliographic entry see Field 02G.
W70-00484

AN INEXPENSIVE METHOD FOR DETERMINING THE DIRECTION OF NATURAL FLOW OF GROUNDWATER,
Irrigation Research Inst., Lahore (Pakistan).
For primary bibliographic entry see Field 02F.
W70-00635

APPLICATION OF AN AIRBORNE PULSED LASER FOR NEAR SHORE BATHYMETRIC MEASUREMENTS,
Syracuse Univ. Research Corp., N.Y.
Daniel G. Hickman, and John E. Hogg.
Remote Sensing of Environ, Vol 1, No 1, p 47-58, Mar 1969. 12 p, 14 fig, 1 tab, 10 ref.

Descriptors: *Bathymetry, *Shores, *Lakes, *Measurement, *Remote sensing, *Aircraft, Lake Ontario, Water storage, Turbidity, Velocity.
Identifiers: Airborne pulsed laser, Bathymetric measurements.

Feasibility of using a pulsed blue-green laser as an airborne Bathymetric sensor for near-shore beach reconnaissance surveys was investigated by using an experimental water tank and a laser transmitter-receiver system flown over the shores of Lake Ontario. Water depths to 26 ft were recorded in the study; maximum depth capability of the laser system is limited by turbidity of the water. In fairly clear water the depth-measuring capability is about 120 ft. The shallow water resolution is 1.5 ft. An aircraft flying at 300 miles/hr could obtain data points every 20 ft over an area of 5-50 sq miles each hr. (Gabriel-USGS)
W70-00636

THERMAL STRATIFICATION IN THE ARCTIC OCEAN,
Oregon State Univ., Corvallis; and Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 02C.
W70-00638

OPTICAL METHOD FOR DETERMINING PARTICLE SIZES OF COARSE SEDIMENT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-00655

HYDROLOGICAL REQUIREMENTS FOR WEATHER RADAR DATA,
For primary bibliographic entry see Field 02B.
W70-00673

WATER BUDGET STUDIES IN KARST AQUIFERS,
McMaster Univ., Hamilton (Ontario). Dept. of Geography; and Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02F.
W70-00676

RECONNAISSANCE ESTIMATION OF STREAM DISCHARGE-FREQUENCY RELATIONSHIPS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
For primary bibliographic entry see Field 02E.
W70-00698

MEASURING ANGLES WITH A CARPENTER'S FOLDING RULER,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
M. Martinelli, Jr., and R. A. Schmidt, Jr.
USDA Forest Service Research Note RM 152, 1969. 2 p, 1 tab.

Descriptors: *Equipment, *Research equipment, *Surveying instruments, Colorado.
Identifiers: *Field protractor, Measurement of angles, Ruler.

A table is given that permits marking 6-foot and 2-meter folding rulers so they can be used to measure angles directly. Accuracy varies from 2 1/2 to 5 degrees. (Martinelli-Forest Service)
W70-00760

7C. Evaluation, Processing and Publication

GENERALIZATION OF STREAMFLOW CHARACTERISTICS FROM DRAINAGE BASIN CHARACTERISTICS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-00440

A STUDY OF THE ECONOMIC IMPACT OF WATER IMPOUNDMENT THROUGH VALIDITY TESTING OF A COMPARATIVE-PROJECTOR MODEL,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 06A.
W70-00479

SNOWY RANGE WATER RESOURCE OBSERVATORY (A Progress Report).
Wyoming Univ., Laramie.

Wyoming Univ Water Resources Research Institute, Water Resources Series No 15, Sept, 1969. 50 p, 1 tab, 1 fig, 3 ref, append. Paul A. Rechard, Ed.

Descriptors: *Instrumentation, *Data processing, Watersheds, *Operation and maintenance.
Identifiers: Anemometers, *Computers, Evaporation pans, Gages, Hygrothermographs, Observation wells, Precipitation gages, Pyrheliographs, Pyrometers, Soil moisture meters, Thermometers.

The instrumentation within the Snowy Range Water Resource Observatory is described. Some of the problems of operating and maintaining the instruments are discussed. Methods of portraying the data collected are presented and the ADP card format and computer program for processing hygrothermograph records is given. Resumes of single discipline research within the observatory during 1966-1969 are given, together with some conclusions as to interdisciplinary considerations.
W70-00480

OPTIMUM ALLOCATION OF WATER RESOURCES BY MATHEMATICAL PROGRAMMING,
Rand Water Board, Johannesburg (South Africa).
For primary bibliographic entry see Field 06A.
W70-00641

COMPUTER-ORIENTED METHOD OF OPTIMIZING HYDROLOGIC MODEL PARAMETERS,
Soil Conservation Service, Chickasha, Okla. Southern Plains Branch; and Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 06A.
W70-00642

APPLICATION OF THE SPECTRAL ANALYSIS METHOD TO THE PRE-ESTIMATION OF TIDES (IN RUSSIAN),
For primary bibliographic entry see Field 02L.
W70-00643

SELECTED WATER RESOURCES INDEX FOR WISCONSIN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 10.
W70-00767

08. ENGINEERING WORKS

8A. Structures

INDIANA BOARD OF PUBLIC HARBORS AND TERMINALS.
For primary bibliographic entry see Field 06E.
W70-00591

CASTAWAYS MOTEL V SCHUYLER (PERMISSION TO BUILD A BULKHEAD).
For primary bibliographic entry see Field 06E.
W70-00735

8B. Hydraulics

FLUID DYNAMICS OF MULTIPHASE SYSTEMS,
Illinois Univ., Urbana. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02F.
W70-00469

8C. Hydraulic Machinery

APPARATUS FOR TEMPERATURE MEASURING IN THE STUDIES OF DISCHARGES BY WATER PUMPS, USING THERMODYNAMICAL METHOD (IN FRENCH),
Central Creil Exploitation Service (France); and Departments of Tests and Thermal Studies (France).
For primary bibliographic entry see Field 04A.
W70-00679

8D. Soil Mechanics

DIFFERENTIAL EQUATION OF THE EVOLUTION OF DELUVIAL SLOPES (IN RUSSIAN),
Kazan State Univ. (USSR). Dept. of Geography.
For primary bibliographic entry see Field 02J.
W70-00648

8E. Rock Mechanics and Geology

THE PROPOSED SOLWAY FIRTH BARRAGES: A REVIEW OF THE GEOLOGICAL AND GEOTECHNICAL ASPECTS,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
For primary bibliographic entry see Field 04A.
W70-00646

PORE STUDIES OF HIGHLY INDURATED APPALACHIAN ROCKS,
Virginia Univ., Charlottesville. Dept. of Geology; Virginia Highway Research Council, Charlottesville; and Cities Service Oil Co., Tulsa, Okla.
For primary bibliographic entry see Field 02F.
W70-00659

8I. Fisheries Engineering

NETS AND SEINES, STURGEON, SHAD, AND HERRING SEASON.
For primary bibliographic entry see Field 06E.
W70-00585

FISH AND GAME.
For primary bibliographic entry see Field 06E.
W70-00588

FISH AND GAME.
For primary bibliographic entry see Field 06E.
W70-00593

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

WATER-RELATED RESEARCH FOR THE GREAT LAKES REGION,
Michigan Univ., Ann Arbor. Dept. of Conservation; and Michigan Univ., Ann Arbor. Inst. of Science and Technology.
For primary bibliographic entry see Field 02H.
W70-00433

SELECTED WATER RESOURCES INDEX FOR WISCONSIN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 10.
W70-00767

9D. Grants, Contracts, and Research Act Allotments

ANNUAL REPORT FISCAL YEAR 1968-69,
William Whipple, Jr.
New Jersey Water Resources Research Institute Report, Rutgers University - The State University, New Brunswick, New Jersey, July 1969. 68 p.

Descriptors: *Research grants, *Research facilities, *Water resources development, Economics, Urbanization, Biochemical oxygen demand, Dissolved oxygen.
Identifiers: *Water resources research administration, Oxygen dynamics of streams, Instream aeration, Interdisciplinary research.

A report on research and training activities of the New Jersey Water Resources Research Institute during fiscal year 1969 under provisions of PL 88-379. Includes mainly activities at Rutgers University, with participation in some projects by Princeton University and Stevens Institute. Thirty projects active, funded mainly by Office of Water Resources Research and the Federal Water Pollution Control Administration, with matching funds from the New Jersey Department of Conservation and Economic Development. The chosen theme of the institute is metropolitan area water resources, and the two major fields of activity are: (1) Oxygen dynamics and biochemical oxygen demand of streams including instream aeration, and (2) Economics of water resources.
W70-00733

ANNUAL REPORT 1968-1969.
Hawaii Univ., Honolulu. Water Resources Research Center.

Hawaii Water Resources Research Center Report, Aug 1969. 121 p. OWRR Project A-999-HI.

Descriptors: *Hawaii, Floods, *Hydrogeology, Aquifer characteristics, *Geophysical exploration, Well logging, Groundwater tides, Groundwater recharge, *Groundwater pollution, Water color, Tracers, Estuarine pollution, Hydrologic data, Irrigation, Evapotranspiration, Water values.

Annual progress report on the research program of the University of Hawaii Water Resources Research Center: the work reported includes studies of floods in small watersheds, aspects of the geohydrology of certain areas on Oahu, Maui, and Hawaii, surface and aerial geophysical exploration for groundwater and geophysical well logging, tidal oscillations in groundwater, identification of groundwater pollution effects, the pollution of certain estuaries, the removal of color from surface water, water tracing and dating, the design of hydrologic data network, the water use of sugar cane, and the value of water for irrigating sugar cane. (Cox-Hawaii Univ)
W70-00764

10. SCIENTIFIC AND TECHNICAL INFORMATION

A CLIMATOLOGICAL BIBLIOGRAPHY OF THE SOUTH ATLANTIC OCEAN AREA, INCLUDING CERTAIN COASTAL COUNTRIES,
Environmental Technical Applications Center (Air Force) Washington, D.C.
Alvin L. Smith, Jr.
USAF, Air Weather Service, ETAC Technical Note 68-4, Nov 1968. 100 p, 262 ref. Available from the Clearinghouse as USAF ETAC TN 68-4, $3.00 in paper copy, $0.65 in microfiche. AD-683 761.

Descriptors: *Climatology, *Bibliography.
Identifiers: South Atlantic Ocean Area, S. Atlantic Coastal Countries.

This bibliography contains climatological references, with annotations, for the South Atlantic Ocean Area, Atlantic Coastal Countries of Africa and S. America, and Antarctica. Items are indexed by author (alphabetically), by country or areas, and by weather parameters (code).
W70-00481

AN ANNOTATED CLIMATOLOGICAL BIBLIOGRAPHY OF ROMANIA,
Environmental Technical Applications Center (Air Force), Washington, D.C.
Vincent J. Creasi.
USAF, Air Weather Service, ETAC Tech Note 69-3, May 1969. 33 p, 61 ref, subject index. Available from the Clearinghouse as USAF ETAC TN 69-3, $3.00 in paper copy, $0.65 in microfiche. AD-688 259.

Descriptors: *Bibliography, *Climatology.
Identifiers: Romania.

This bibliography contains 61 separate sources on climatological data and textual references for

Romania. All entries are in alphabetical order by author or originating agency. All items are furnished with a brief abstract. A subject index of the times is included. All items indicate the source library where the reference is filed.
W70-00482

BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS: A SELECTED ANNOTATED BIBLIOGRAPHY,
Tennessee Valley Authority, Washington, D.C.
For primary bibliographic entry see Field 06B.
W70-00495

WATER RESOURCE INFORMATION FOR PLANNING AND MANAGEMENT,
Illinois Geological Survey.
For primary bibliographic entry see Field 06B.
W70-00515

SEWAGE FUNGUS: ITS NATURE AND EFFECTS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05C.
W70-00637

BACTERIA, CARBON DIOXIDE, AND ALGAL BLOOMS,
Wyandotte Chemical Corp., Mich.
For primary bibliographic entry see Field 05C.
W70-00664

PESTICIDES AND FISHES--A REVIEW OF SELECTED LITERATURE,
Arizona State Univ., Tempe. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W70-00718

SELECTED WATER RESOURCES INDEX FOR WISCONSIN,
Wisconsin Univ., Madison.
P. D. Uttormark, L. J. Nunnelee, and L. C. Utter.
Available from the Clearinghouse as PB-187 312 $3.00 in paper copy, $0.65 in microfiche. Also available for $3.00 per copy from University of Wisconsin Water Resources Center, Madison, Wisconsin. Wisconsin Water Resource Center, July 1969. 222 p, key word index, author index. OWRR Project A-999-WIS.

Descriptors: *Wisconsin, *Bibliographies, *Documentation, Publications.

This index was prepared to aid those concerned with water resources in Wisconsin and is designed to answer two basic questions: (1) 'What information is available,' and (2) 'Where is this information located.' The source material for this index is limited to that found at the University of Wisconsin at Madison and only those references which pertain directly to Wisconsin are included. Although an attempt was made to be thorough in preparing this index, no doubt some references have been omitted. Without question, the compilation of a comprehensive index, pertaining to water and related resources of Wisconsin, would be of significant value as a basis for solving many of the state's water resources problems. Although this publication is not comprehensive, hopefully it will provide stimulus for additional effort. (Rohlich-Wisconsin Univ)
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WATER USE AND THERMAL POLLUTION,
W70-00742 05C

ELDORADO MINING AND REFINING LTD., MONTREAL (QUEBEC).
AN ORIENTATION STUDY OF THE URANIUM DISTRIBUTION IN LAKE WATERS, BEAVERLODGE DISTRICT, SASKATCHEWAN,
W70-00423 02H

ENVIRONMENTAL TECHNICAL APPLICATIONS CENTER (AIR FORCE) WASHINGTON, D.C.
A CLIMATOLOGICAL BIBLIOGRAPHY OF THE SOUTH ATLANTIC OCEAN AREA, INCLUDING CERTAIN COASTAL COUNTRIES,
W70-00481 10

ENVIRONMENTAL TECHNICAL APPLICATIONS CENTER (AIR FORCE), WASHINGTON, D.C.
AN ANNOTATED CLIMATOLOGICAL BIBLIOGRAPHY OF ROMANIA,
W70-00482 10

RADAR-COMPUTED RAINFALL COMPARED WITH OBSERVATIONS FROM A DENSE NETWORK OF RAIN GAUGES,
W70-00483 07A

TRACTIONABILITY STUDY FOR THE LAOTIAN PANHANDLE,
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EUGENE WATER AND ELECTRIC BOARD, OREG.
CREDIT AND COLLECTION POLICIES AT EUGENE, OREGON,
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FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, ATHENS, GA. SOUTHEAST WATER LAB.
NEUTRALIZATION OF ACID MINE DRAINAGE,
W70-00662 05D

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO. DIV. OF TECHNICAL SERVICES.
BIOCHEMICAL OXYGEN DEMAND AND DEGRADATION OF LIGNIN IN NATURAL WATERS,
W70-00681 05B

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, DULUTH, MINN. NATIONAL WATER QUALITY LAB.
THE USE OF ARTIFICIAL SUBSTRATES IN POLLUTION SURVEYS,
W70-00666 05B

FLORIDA UNIV., GAINESVILLE, AND NORTHWESTERN UNIV., EVANSTON, ILL.
PRODUCTION COST FACTOR IN RATE-MAKING,
W70-00602 06C

FLORIDA UNIV., GAINESVILLE. WATER RESOURCES RESEARCH CENTER.
WATER LAW AND ADMINISTRATION - THE FLORIDA EXPERIENCE,
W70-00527 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 1 INTRODUCTION,
W70-00528 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 2 RIGHTS IN DEFINED WATERBODIES BASIC CONSIDERATIONS,
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WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 3 OWNERSHIP OF UPLAND AS THE SOURCE OF RIPARIAN RIGHTS,
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WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 4 NONCONSUMPTIVE USES OF NATURAL NAVIGABLE WATERBODIES,
W70-00531 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 5 CONSUMPTIVE USE OF WATER COMMON LAW RULES,
W70-00532 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 6 STATUTORY MODIFICATIONS OF EASTERN CONSUMPTIVE USE DOCTRINES,
W70-00533 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 7 RIGHTS IN DISPOSAL OF DIFFUSED SURFACE WATER,
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WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 8 FEDERAL AUTHORITY AND ACTIVITY AFFECTING FLORIDA'S WATER RESOURCES,
W70-00535 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 9 STATE ADMINISTRATION OF WATER RESOURCES IN FLORIDA,
W70-00536 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 10 SINGLE PURPOSE AND MULTIPURPOSE WATER MANAGEMENT DISTRICTS,
W70-00537 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 11 THE LAW AND ADMINISTRATION OF POLLUTION CONTROL IN FLORIDA,
W70-00538 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 12 TITLE TO BEDS UNDER NAVIGABLE WATERS,
W70-00539 06E

WATER LAW AND ADMINISTRATION--THE FLORIDA EXPERIENCE CHAPTER 13 A LOOK TO THE FUTURE,
W70-00540 06A

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, ROME (ITALY). LAND AND WATER DEVELOPMENT DIV. CALIFORNIA UNIV., LOS ANGELES. WATER RESOURCES CENTER AND INTERNATIONAL STUDY CENTER FOR SPRINKLER IRRIGATION, VERONA (ITALY).
SPRINKLER IRRIGATION,
W70-00695 03F

FOREST SERVICE (USDA), ALBUQUERQUE, N. MEX. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
ESTABLISHMENT AND SURVIVAL OF SEVERAL GRASSES IN THE SAGEBRUSH TYPE, WEST-CENTRAL NEW MEXICO,
W70-00762 04D

FOREST SERVICE (USDA), BERKELEY, CALIF. PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION.
SNOWPACK MANAGEMENT,
W70-00763 02C

FOREST SERVICE (USDA), FORT COLLINS, COLO. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
MEASURING ANGLES WITH A CARPENTER'S FOLDING RULER,
W70-00760 07B

FOREST SERVICE (USDA), GRAND RAPIDS, MINN. NORTHERN CONIFERS LAB.
RUNOFF FROM SMALL PEATLAND WATERSHEDS,
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FOREST SERVICE (USDA), ST. PAUL, MINN. NORTH CENTRAL FOREST EXPERIMENT STATION.
PHYSICAL PROPERTIES OF PEATS AS RELATED TO DEGREE OF DECOMPOSITION,
W70-00761 02G

GEOLOGICAL SURVEY OF CANADA, OTTAWA (ONTARIO).
THE USE OF RADON-222 IN SURFACE WATERS IN GEOCHEMICAL PROSPECTING FOR URANIUM,
W70-00421 02J

GEOLOGICAL SURVEY OF NEW ZEALAND, CHRISTCHURCH. SEDIMENTATION LAB.
ENVIRONMENTALLY SIGNIFICANT SEDIMENTOLOGIC CHARACTERISTICS OF BEACH SANDS,
W70-00650 02L

GEOLOGICAL SURVEY, ALBANY, N.Y.
RESULTS OF SUBSURFACE EXPLORATION IN THE MID-ISLAND AREA OF WESTERN SUFFOLK COUNTY, LONG ISLAND, NEW YORK,
W70-00455 02F

A RECONNAISSANCE OF STREAM SEDIMENT IN THE ERIE-NIAGARA BASIN, NEW YORK,
W70-00466 02J

GROUNDWATER RESOURCES OF THE ERIE-NIAGARA BASIN, NEW YORK,
W70-00687 02F

CHEMICAL QUALITY OF STREAMS IN THE ERIE-NIAGARA BASIN, NEW YORK,
W70-00688 02K

SURFACE WATER IN THE ERIE-NIAGARA BASIN, NEW YORK,
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GEOLOGICAL SURVEY, PHOENIX, ARIZ.

GROUND-WATER CONDITIONS IN MCMULLEN VALLEY, MARICOPA, YUMA AND YAVAPAI COUNTIES, ARIZONA,
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GEOLOGICAL SURVEY, TACOMA, WASH.
THREE-DIMENSIONAL SURGES AND RECOVERIES IN A NUMERICAL GLACIER MODEL,
W70-00443 02C

GEOLOGICAL SURVEY, TRENTON, N.J.
GROUNDWATER RESOURCES OF MONMOUTH COUNTY, NEW JERSEY,
W70-00465 02F

GEOLOGICAL SURVEY, WASHINGTON, D.C.
STAGE-DISCHARGE CHARACTERISTICS OF A WEIR IN A SAND-CHANNEL STREAM,
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ESTUARINE STUDIES IN UPPER GRAYS HARBOR, WASHINGTON,
W70-00419 02L

WATER RESOURCES OF RANDOLPH AND LAWRENCE COUNTIES, ARKANSAS,
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GENERALIZATION OF STREAMFLOW CHARACTERISTICS FROM DRAINAGE BASIN CHARACTERISTICS,
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LIMESTONE HYDROLOGY IN THE UPPER STONES RIVER BASIN, CENTRAL TENNESSEE,
W70-00451 02F

SURFACE-WATER RESOURCES OF THE YOBE RIVER SYSTEM, NORTHERN NIGERIA, 1963-68,
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HYDROLOGIC EFFECTS OF THE EARTHQUAKE OF MARCH 27, 1964, OUTSIDE ALASKA,
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GROUNDWATER RECONNAISSANCE IN THE BURNT RIVER VALLEY AREA, OREGON,
W70-00468 02F

CORRELATION AND ANALYSIS OF WATER-TEMPERATURE DATA FOR OREGON STREAMS,
W70-00470 02E

SURFACE WATER AND RELATED CLIMATE FEATURES OF THE SAHIL SUSAH AREA, TUNISIA,
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AVAILABILITY OF GROUND WATER IN YORK COUNTY, NEBRASKA,
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DETERMINATION OF PHENOXY ACID HERBICIDES IN WATER BY ELECTRON-CAPTURE AND MICROCOULOMETRIC GAS CHROMATOGRAPHY,
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HYDROLOGIC DATA FOR THE OAK RIDGE AREA, TENNESSEE,
W70-00476 02E

GROUNDWATER RESOURCES OF THE PASCAGOULA RIVER BASIN, MISSISSIPPI AND ALABAMA,
W70-00477 02F

IMPLICATIONS OF THE MINOR ELEMENT CONTENT OF SOME MAJOR STREAMS OF THE WORLD,
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PANEL DISCUSSION ON WATER QUALITY,
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OPTICAL METHOD FOR DETERMINING PARTICLE SIZES OF COARSE SEDIMENT,
W70-00655 02J

GEOLOGICAL SURVEY, WASHINGTON, D.C. AND GEOLOGICAL SURVEY, RALEIGH, N.C.
HYDROLOGY OF CARBONATE ROCK TERRANES, A REVIEW-WITH SPECIAL REFERENCE TO THE UNITED STATES (PART 1),
W70-00454 02F

GEORGE WASHINGTON UNIV., WASHINGTON, D.C.
EXPERIMENTAL DISSOLUTION OF CALCIUM, MAGNESIUM, AND STRONTIUM FROM RECENT BIOGENIC CARBONATES A MODEL OF DIAGENESIS,
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FEDERAL NATURAL RESOURCES DEVELOPMENT BASIC ISSUES IN BENEFIT AND COST MEASUREMENT,
W70-00494 06B

GUELPH UNIV. (ONTARIO). DEPT. OF SOIL SCIENCE.
NITROGEN CONTAMINATION OF GROUNDWATER BY BARNYARD LEACHATES,
W70-00665 05B

HARVARD UNIV., CAMBRIDGE, MASS.
MEASURING BENEFITS OF GOVERNMENT INVESTMENTS.
W70-00622 06B

HAWAII UNIV., HONOLULU.
HYDROGRAPH STUDY AND PEAK DISCHARGE DETERMINATION OF HAWAIIAN SMALL WATERSHEDS ISLAND OF OAHU,
W70-00449 02A

HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.
ANNUAL REPORT 1968-1969.
W70-00764 09D

ICELAND UNIV., REYKJAVIK. SCIENCE INST.
THE EXCHANGE OF HYDROGEN ISOTOPES BETWEEN ICE AND WATER IN TEMPERATURE GLACIERS,
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IDAHO UNIV., MOSCOW. WATER RESOURCES RESEARCH INST.
HYDROLOGY OF FROZEN GROUND FLOODS,
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SOCIAL PROBLEMS NEEDING SOLUTIONS, STATE AGENCIES,
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ILLINOIS DEPT. OF REGISTRATION AND EDUCATION, URBANA.
COST OF MUNICIPAL SEWAGE TREATMENT,
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ILLINOIS GEOLOGICAL SURVEY.
WATER RESOURCE INFORMATION FOR PLANNING AND MANAGEMENT,
W70-00515 06B

ILLINOIS STATE BAR ASSOCIATION.
ILLINOIS DRAINAGE LAW (A COMMENTARY),
W70-00815 04A

ILLINOIS STATE BOARD OF ECONOMIC DEVELOPMENT.
THE ILLINOIS STATE PLANNING PROGRAM,
W70-00753 06B

ILLINOIS PLANNING STUDIES AND COORDINATING ACTIVITIES,
W70-00754 06B

ILLINOIS UNIV., URBANA AND INTERNATIONAL RICE RESEARCH INST., LOS BANOS (PHILIPPINES).
REGIONAL DIFFERENCES IN THE IMPACT OF IRRIGATION ON FARM OUTPUT,
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ILLINOIS UNIV., URBANA. DEPT. OF MECHANICAL ENGINEERING.
FLUID DYNAMICS OF MULTIPHASE SYSTEMS,
W70-00469 02F

INSTITUTE OF PUBLIC ADMINISTRATION, WASHINGTON, D.C. AND NATIONAL PLANNING ASSOCIATION, WASHINGTON, D.C.
OUTDOOR RECREATION,
W70-00623 06B

IOWA STATE UNIV., AMES. DEPT. OF EARTH SCIENCES.
GEOLOGY OF THE REGOLITH AQUIFERS OF THE NISHNABOTNA BASIN,
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IRRIGATION RESEARCH INST., LAHORE (PAKISTAN).
AN INEXPENSIVE METHOD FOR DETERMINING THE DIRECTION OF NATURAL FLOW OF GROUNDWATER,
W70-00635 02F

KAZAN STATE UNIV. (USSR). DEPT. OF GEOGRAPHY.
DIFFERENTIAL EQUATION OF THE EVOLUTION OF DELUVIAL SLOPES (IN RUSSIAN),
W70-00648 02J

KENTUCKY UNIV., LEXINGTON.
ECONOMIC ANALYSIS OF ALTERNATIVE FLOOD CONTROL MEASURES BY DIGITAL COMPUTER,
W70-00617 06A

LIBRARY OF CONGRESS, WASHINGTON, D.C. SCIENCE AND TECHNOLOGY DIV.
AIR POLLUTION PUBLICATIONS - A SELECTED BIBLIOGRAPHY WITH ABSTRACTS, 1966-1968.
W70-00452 05G

LONG BEACH DEPT. OF OIL PROPERTIES, CALIF.
REDUCING LAND SUBSIDENCE IN THE WILMINGTON OIL FIELD BY THE USE OF SALINE WATERS,
W70-00447 05G

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF METEOROLOGY.
AN EXPERIMENTAL IN SITU DENSITOMETER,
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MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF GEOGRAPHY AND WATERLOO UNIV. (ONTARIO). DEPT. OF MECHANICAL ENGINEERING.
WATER BUDGET STUDIES IN KARST AQUIFERS,
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MIAMI UNIV., FLA. INST. OF MARINE SCIENCE.
THE UPTAKE, ACCUMULATION AND EXCHANGE OF STRONTIUM-90 BY OPEN SEA PHYTOPLANKTON,
W70-00707 05C

MICHIGAN STATE UNIV., EAST LANSING.
PERSPECTIVES ON ENVIRONMENTAL PLANNING AND RESOURCE DEVELOPMENT,
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MICHIGAN UNIV., ANN ARBOR. DEPT. OF CONSERVATION AND MICHIGAN UNIV., ANN ARBOR. INST. OF SCIENCE AND TECHNOLOGY.
WATER-RELATED RESEARCH FOR THE GREAT LAKES REGION,
W70-00433 02H

MINISTRY OF AGRICULTURE AND WATER, RIYADH (SAUDI ARABIA).
THE PROPOSED SOLWAY FIRTH BARRAGES A REVIEW OF THE GEOLOGICAL AND GEOTECHNICAL ASPECTS,
W70-00646 04A

MINNESOTA UNIV., ST. PAUL. AGRICULTURE EXTENSION SERVICE.
UNDERSTANDING THE WATER QUALITY CONTROVERSY IN MINNESOTA,
W70-00430 05G

MISSOURI UNIV., KANSAS CITY. DEPT. OF CHEMISTRY.
RADIOMETRIC AND SPECTROPHOTOMETRIC DETERMINATION OF TRACE

AMOUNTS OF SELENIUM USING 3, 3' -DIAMINOBENZIDINE AS THE INITIAL REAGENT,
W70-00460 05A

MOSCOW STATE UNIV. (USSR).
CALCULATION OF SEDIMENT BALANCE OF THE LITTORAL ZONE (IN RUSSIAN),
W70-00649 02L

AN INVESTIGATION OF THE RELATIONSHIPS BETWEEN LANDSCAPE-GEOMORPHOLOGICAL FACTORS AND SEDIMENT RUNOFF OF THE RIVERS OF THE WESTERN TRANSCAUCASUS (IN RUSSIAN),
W70-00656 02J

MOSCOW STATE UNIV. (USSR). DEPT. OF METEOROLOGY AND MOSCOW STATE UNIV. (USSR). DEPT. OF CLIMATOLOGY.
THE USE OF EXPONENTIAL FUNCTIONS WHEN CONSTRUCTING THE LAWS OF THE DISTRIBUTION OF GEOGRAPHICAL AND HYDROMETEOROLOGICAL PARAMETERS (IN RUSSIAN),
W70-00657 02A

NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL, WASHINGTON, D.C.
LAND USE ALONG A TROPICAL CLIMATIC BOUNDARY THE WALAWE GANGA BASIN OF CEYLON,
W70-00463 03B

NATIONAL BUREAU OF ECONOMIC RESEARCH, NEW YORK.
ANTICIPATING THE NATIONS NEED FOR ECONOMIC KNOWLEDGE,
W70-00620 6B

NATIONAL INST. OF OCEANOGRAPHY, WORMLEY (ENGLAND).
DIRECT ILLUSTRATION OF ONE WAY SAND TRANSPORT BY TIDAL CURRENTS,
W70-00436 02J

NATIONAL PLANNING ASSOCIATION, WASHINGTON, D.C. CENTER FOR TECHNO-ECONOMIC STUDIES.
THE ROLE OF MARINE SCIENCES IN THE MULTIPLE USES OF THE COASTAL ZONE OF LAKE ERIE AND LAKE SUPERIOR,
W70-00457 02L

NEBRASKA UNIV., LINCOLN.
ENGINEERING PHASES OF LAND TREATMENT RELATED TO INCREASING WATER-USE EFFICIENCY AND STORAGE EFFICIENCY RAINFALL,
W70-00448 04A

AGRICULTURAL METEOROLOGY IN ISRAEL,
W70-00691 03F

NEBRASKA UNIV., LINCOLN. AGRICULTURAL EXPERIMENT STATION AND NEBRASKA UNIV., LINCOLN. DEPT. OF HORTICULTURE AND FORESTRY.
ADVECTIVE CONTRIBUTION OF ENERGY UTILIZED IN EVAPOTRANSPIRATION BY ALFALFA IN THE EAST CENTRAL GREAT PLAINS (U.S.A.),
W70-00690 02D

NEBRASKA UNIV., LINCOLN. COLL. OF AGRICULTURE AND HOME ECONOMICS AND NEBRASKA UNIV., AGRICULTURAL EXPERIMENT STATION.
RESEARCH IN EVAPOTRANSPIRATION,
W70-00450 02D

NETHERLANDS SCHOOL OF ECONOMICS, ROTTERDAM.
EFFICIENCY IN GOVERNMENT SPENDING,
W70-00615 06B

NEVADA FISH AND GAME DEPT., RENO AND CALIFORNIA STATE DEPT. OF FISH AND GAME, SACRAMENTO. INLAND FISHERIES BRANCH.
OBSERVATIONS ON DEEPWATER PLANTS IN LAKE TAHOE, CALIFORNIA AND NEVADA,
W70-00711 02H

NEW HAMPSHIRE UNIV., DURHAM. DEPT. OF ZOOLOGY.
GROWTH AND RESISTANCE TO STRESS IN BROOK TROUT FED SUBLETHAL LEVELS OF DDT,
W70-00684 05C

NEW YORK STATE DEPT. OF HEALTH, ALBANY. BUREAU OF RADIOLOGICAL HEALTH.
ENVIRONMENTAL SURVEILLANCE AROUND A NUCLEAR FUEL REPROCESSING INSTALLATION, 1965-1967,
W70-00677 05C

NEW ZEALAND OCEANOGRAPHIC INST., WELLINGTON. DEPT. OF SCIENTIFIC AND INDUSTRIAL RESEARCH.
RECENT SEDIMENTATION AROUND NORTHERNMOST NEW ZEALAND,
W70-00645 02J

OFF-SHORE SEDIMENTS, NORTH-WEST NELSON, SOUTH ISLAND, NEW ZEALAND,
W70-00660 02L

THE APPEARANCE AND ORIGIN OF COLOURS IN MUDDY MARINE SEDIMENTS AROUND NEW ZEALAND,
W70-00661 02L

NORTH CAROLINA STATE UNIV., RALEIGH AND CHASE MANHATTAN BANK, NEW YORK.
OPTIMAL WATER ALLOCATION THE NORTH PLATTE RIVER,
W70-00629 06D

NORTHWEST PULP AND PAPER ASSOCIATION.
PANEL DISCUSSION ON WATER QUALITY,
W70-00504 06B

NORTHWESTERN ILLINOIS PLANNING COMMISSION.
PLANNING FOR WATER RESOURCE DEVELOPMENT THE FORMULATION OF A STRATEGY,
W70-00512 06B

NORTHWESTERN UNIV., EVANSTON, ILL.
COMMENT ON THE PLACE OF WATER RESOURCES PLANNING IN ECONOMIC REGIONAL DEVELOPMENT,
W70-00614 06B

OBERLIN COLL., OHIO. DEPT. OF BIOLOGY.
COMPARATIVE ECOLOGY OF SANDSPIT PONDS,
W70-00671 02L

OHIO STATE UNIV., COLUMBUS TEXAS A AND M UNIV., COLLEGE STATION AND WRIGHT STATE UNIV., FAIRBORN, OHIO.
SPATIAL BEHAVIOR IN RECREATIONAL BOATING,
W70-00601 06D

OHIO STATE UNIV., COLUMBUS.
PLANT SIZING FOR A SEASONAL PRODUCT DEMAND USING A LINEAR PROGRAMMING MODEL,
W70-00604 06A

OREGON STATE UNIV., CORVALLIS AND NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
THERMAL STRATIFICATION IN THE ARCTIC OCEAN,
W70-00638 02C

OREGON STATE UNIV., CORVALLIS.
SOME OBSERVATIONS ON ECONOMIC EVALUATION STUDIES,
W70-00499 06C

PANEL DISCUSSION ON WATER QUALITY CONTROL,
W70-00502 06B

OREGON STATE UNIV., CORVALLIS. DEPT. OF FISHERIES AND WILDLIFE.
ACCUMULATION OF DIELDRIN BY FISH AND SELECTED FISH-FOOD ORGANISMS,
W70-00714 05C

OREGON STATE WATER RESOURCES BOARD.
OREGON STATE INTEREST AND VIEWPOINT IN RIVER BASIN PLANNING IN THE WILLAMETTE COMPREHENSIVE STUDY,
W70-00509 06E

OREGON UNIV., EUGENE.
FORECASTING REGIONAL ECONOMIC GROWTH SOME PROBLEMS AND PITFALLS,
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OTAGO UNIV., DUNEDIN (NEW ZEALAND). DEPT. OF GEOGRAPHY.
EARTHFLOW OCCURRENCE DURING HIGH INTENSITY RAINFALL IN EASTERN OTAGO (NEW ZEALAND),
W70-00647 02B

PENNSYLVANIA GEOLOGICAL SURVEY, HARRISBURG.
STRATIGRAPHY AND SEDIMENTOLOGY OF THE TERTIARY ROCKS OF THE MANDAMUS-DOVE RIVER AREA, NORTH CANTERBURY, NEW ZEALAND,
W70-00644 02J

PENNSYLVANIA UNIV., PHILADELPHIA. UNIV. MUSEUM.
A DIVERSIFIED PROGRAM FOR THE STUDY OF SHALLOW WATER SEARCHING AND MAPPING TECHNIQUES,
W70-00461 07B

PRINCETON UNIV., N.J. DEPT. OF ECONOMICS.
GOVERNMENT RESEARCH AND DEVELOPMENT PROGRAMS,
W70-00621 06B

PUBLIC HEALTH SERVICE, WASHINGTON, D.C.
A CLIMATOLOGICAL EVALUATION OF PRECIPITATION PATTERNS,
W70-00740 04C

PURDUE UNIV., LAFAYETTE, IND.
ERODIBILITY OF SAND-CLAY MIXTURES AS EVALUATED BY A WATER JET,
W70-00724 02J

STATISTICAL ANALYSIS OF MEANDERING RIVER GEOMETRY,
W70-00725 02E

RAND WATER BOARD, JOHANNESBURG (SOUTH AFRICA).
OPTIMUM ALLOCATION OF WATER RESOURCES BY MATHEMATICAL PROGRAMMING,
W70-00641 06A

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D.C.
EFFLUENT CHARGES,
W70-00489 05G

RESEARCH GOALS AND PROGRESS TOWARD THEM,
W70-00619 05G

THE WATER RESOURCES OF CHILE AN ECONOMIC METHOD FOR ANALYZING A KEY RESOURCE IN A NATION'S DEVELOPMENT,
W70-00699 06B

RHODE ISLAND UNIV., KINGSTON. NARRAGANSETT MARINE LAB.
SEASONAL SELECTION OF ESTUARINE BACTERIA BY WATER TEMPERATURE,
W70-00713 05C

ROCKETDYNE, CANOGA PARK, CALIF. RESEARCH DIV.
MONITORING INDUSTRIAL POLLUTANTS BY THE PYROLYSIS-METHANE DETECTION METHOD,
W70-00682 05B

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N.J. DEPT. OF GEOLOGY.
HYDROLOGY OF SOUTH BONAIRE, N. A. - A ROCK SELECTIVE DOLOMITIZATION MODEL,
W70-00441 02F

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N.J. DEPT. OF MECHANICAL AND AEROSPACE ENGINEERING.
LAWS OF DISPERSION,
W70-00732 01A

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N.J. WATER RESOURCES RESEARCH INST.
OPTIMUM INPSTMENT IN STRUCTURAL FLOOD CONTROL,
W70-00729 06B

SAN DIEGO, CALIF.
CONTROLLING ACCIDENT COMPENSATION COSTS,
W70-00598 06C

SHELL DEVELOPMENT CO., HOUSTON, TEX. EXPLORATION AND PRODUCTION RESEARCH DIV. AND JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOLOGY.
ANATOMY OF A MODERN CARBONATE TIDAL-FLAT, ANDROS ISLAND, BAHAMAS,
W70-00445 02J

SOIL CONSERVATION SERVICE, CHICKASHA, OKLA. SOUTHERN PLAINS BRANCH AND GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF CIVIL ENGINEERING.
COMPUTER-ORIENTED METHOD OF OPTIMIZING HYDROLOGIC MODEL PARAMETERS,
W70-00642 06A

SOUTH DAKOTA STATE UNIV., BROOKINGS. COLL. OF AGRICULTURE AND BIOLOGICAL SCIENCES.
ECONOMIC EFFECTS OF USING SUBSTANDARD QUALITY WATER IN WEBSTER AND OTHER COMMUNITIES IN SOUTH DAKOTA.
W70-00727 03C

STANFORD UNIV., CALIF. DEPT. OF CIVIL ENGINEERING.
THE USE OF INVERTEBRATES IN A WATER QUALITY INVESTIGATION A BIOLOGICAL STUDY OF THE MIAMI RIVER, OHIO,
W70-00475 05C

STANFORD UNIV., CALIF. DEPT. OF SANITARY ENGINEERING.
CHEMICAL PROCESSING OF WASTEWATER FOR NUTRIENT REMOVAL,
W70-00680 05D

STATE UNIV. OF NEW YORK, BUFFALO.
TAXATION AND THE DISPOSITION OF DEPRECIABLE ASSETS,
W70-00600 06C

STATE UNIV. OF NEW YORK, STONY BROOK. DEPT. OF EARTH AND SPACE SCIENCES.
OCEANIC CONCENTRATIONS OF RADIUM-228,
W70-00435 02K

SYRACUSE UNIV. RESEARCH CORP., N.Y.
APPLICATION OF AN AIRBORNE PULSED LASER FOR NEAR SHORE BATHYMETRIC MEASUREMENTS,
W70-00636 07B

TALLINN POLYTECHNIC INST. (USSR).
AN EXPERIMENTAL RESEARCH OF COEFFICIENT OF LONGITUDINAL DISPERSION FOR SMALL RIVERS (IN RUSSIAN),
W70-00743 05B

TECHNICAL SCHOOL, NIS (YUGOSLAVIA).
EFFECT OF PHOTOSYNTHESIS ON OXYGEN SATURATION,
W70-00683 05C

TENNESSEE RECHNOLOGICAL UNIV., COOKEVILLE. DEPT. OF BIOLOGY.
A LIMNOLOGICAL STUDY OF A TENNESSEE COLD SPRINGBROOK,
W70-00672 02I

TENNESSEE VALLEY AUTHORITY, KNOXVILLE. DIV. OF FORESTRY DEVELOPMENT.
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SELECTED WATER RESOURCES ABSTRACTS

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Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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SELECTED
WATER RESOURCES ABSTRACTS

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VOLUME 3, NUMBER 3
FEBRUARY 1, 1970

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
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U.S. Department of the Interior
Washington, D. C. 20240

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Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

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ABSTRACT SOURCES

02. WATER CYCLE

2A. General

. LABORATORY STUDY OF SURFACE RU-OFF DUE TO MOVING RAINSTORMS,
linois Univ., Urbana.
en Chie Yen, and Ven Te Chow.
ISF Grant GK-1155. Water Resources Res, Vol 5, lo 5, p 989-1006, Oct 1969. 18 p, 7 fig, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Runoff forecasting, *Rainfall disposition, Hydrographs, Hydrograph analysis, Dimensional analysis, Distribution patterns, Mathematical models.
Identifiers: Moving rainstorms, Rainfall distribution.

The movement of a rainstorm determines the spatial and temporal distributions of the rainfall over a watershed and hence affects the characteristics of the flow on the watershed. In this study the importance of the movement of rainstorms on the time distribution of the surface runoff from watersheds is demonstrated through the use of a laboratory watershed experimentational system. Experiments were performed on the impervious square watershed for 2 rainfall intensities, 4 surface slopes, and 14 rainstorm velocities. Analysis of the mechanics of water flowing on watersheds is attempted to explain the influence of movement of rainstorms on the characteristics of surface runoff hydrographs. (Knapp-USGS)
W70-00839

A MODEL FOR RAINFALL ROUTING DURING INITIAL ABSTRACTION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
. X. Dunin.
Hydrol, Vol 9, No 1, p 57-72, Sept 1969. 16 p, 5 ab, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Routing, *Runoff forecasting, *Mathematical models, Model studies, Infiltration, Water storage, On-site tests, Drainage, Percolation, Simulation analysis.
Identifiers: *Rainfall routing, Australia.

More reliable estimation of runoff requires the development of a model to simulate rainfall disposition prior to runoff production on rural catchments. A mathematical model based on the moisture storage capacities of the upper and subsoil zones of a catchment was developed. Its general form was confirmed by comparison of predicted values with recorded data on initial abstraction from 4 pastoral catchments on texture-contrast soils with heavy clay subsoils at the Parwan Experimental Area, near Bacchus Marsh, Victoria, Australia. The modifications necessary for extending this model to ungaged areas are elaborated and changes in the elements of the model following pasture improvement are discussed. (Knapp-USGS)
W70-00844

EFFECT OF RAINFALL VARIABILITY ON STREAMFLOW SIMULATION,
Geological Survey, Menlo Park, Calif. Water Resources Div.
D. R. Dawdy, and J. M. Bergman.
Water Resources Res, Vol 5, No 5, p 958-966, Oct 1969. 9 p, 3 fig, 2 tab, 2 ref.

Descriptors: *Rainfall-runoff relationships, *Statistical methods, *Mathematical models, *Variability, Correlation analysis, Simulation analysis, Evaporation, Hydraulic conductivity, Soil moisture, Infiltration, Routing, Streamflow forecasting.
Identifiers: *Rainfall variability.

Three recording rain gages in a 9.7-square mile basin in southern California were used with a deterministic rainfall-runoff model to simulate flood hydrographs and peaks and to assess the effects of data errors on simulation results. Bias in the estimation of effective basin rainfall seemed to result in curve fitting parameter adjustments which compensated for the bias. The combined effects for a storm of both difference in the time distribution of rainfall at different points and spatial variability of rainfall volume over the basins limit the possible accuracy of simulation results. The use of a single rain gage on a basin with this hydrology can at best be expected to predict peak discharge with a standard error of estimate on the order of 20%. (Knapp-USGS)
W70-00850

CONTINUOUS HYDROGRAPH SYNTHESIS WITH AN API-TYPE HYDROLOGIC MODEL,
Weather Bureau, Silver Spring, Md.
Walter T. Sittner, Charles E. Schauss, and John C. Monro.
Water Resources Res, Vol 5, No 5, p 1007-1022, Oct 1969. 16 p, 12 fig, 2 tab, 1 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Streamflow forecasting, Hydrograph analysis, Synthetic hydrology, Recession curves, Unit hydrographs, Groundwater movement, Antecedent precipitation, Flood forecasting, Simulation analysis.
Identifiers: Hydrologic models, Synthetic hydrographs.

The U.S. ESSA Weather Bureau Hydrologic Research and Development laboratory has developed a complete hydrologic model utilizing an antecedent precipitation index (API) type rainfall-runoff relation to compute surface runoff. With increasing demand for continuous river forecasts as well as flood forecasts, it is necessary to have a model that will predict all components of flood as functions of observable independent parameters on a continuous basis. To formulate the model, existing and proved techniques were used where possible and new techniques developed as necessary. The model consists of 4 basic parts: a relation for computing groundwater recession, a method of computing the groundwater flow hydrograph as a function of the direct runoff hydrograph, an API-type rainfall-runoff relation, and a unit hydrograph. The rainfall-runoff relation is of the incremental type, yielding a runoff computation for each 6-hr period rather than computing the total storm runoff. This has been accomplished through the inclusion of a new parameter, retention index. Two important features of the model are the ease of adjusting parameters to observed flow and the sequential development of the 4 basic parts with a minimum of interaction. (Knapp-USGS)
W70-00860

A CONJUNCTIVE OPERATION OF A SURFACE RESERVOIR AND A GROUNDWATER AQUIFER,
Technion - Israel Inst. of Tech., Haifa.
Nathan Buras.
World Meteorol Organ Int Ass Sci Hydrol Symp, Berkeley, p 492-500, Aug 1963. 9 p, 1 fig, 2 tab, 9 ref.

Descriptors: *Dynamic Programming, *Optimization, *Aquifers, *Surface-groundwater relationships, *Decision making, Reservoir operation, Pumping, Water loss, Water demand, Water supply, Mathematical models.
Identifiers: Lake Tiberias.

A conceptual framework was developed for the problem of operating surface storage facilities in conjunction with groundwater aquifers. The problem of operating the system had two aspects (a) the operation of the reservoir (Lake Tiberias) and of the aquifer so as to minimize losses of water and (b) the supply of water to satisfy demands at minimum cost of pumping. The complex physical system was reduced to a symplified mathematical model which was cast as a problem in sequential decision making. This problem was analyzed using the method of dynamic programming and indicating the form of computational solution. The optimization criterion involved the determiniation of costs connected with the delivery of water and of penalties for not meeting demands. (Thiuri-Cornell)
W70-00906

LINEAR PROGRAMMING FOR HYDROLOGIC ANALYSES,
Michigan Univ., Ann Arbor.
Rolf A. Deininger.
Water Resources Res, Vol 5, No 5, p 1105-1109, Oct 1969. 5 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Mathematical studies, *Linear programming, *Mathematical models, Simulation analysis, Least squares method, Hydrograph analysis.
Identifiers: Hydrologic models.

The estimation of the parameters of hydrologic models often poses difficulties since nonnegativity requirements, inequalities, and other constraints limit the use of standard statistical analyses. The use of linear programming techniques to estimate the parameters based on the criteria of minimum absolute deviations and on minimum maximum deviations appears to be advantageous since well-established algorithms and computer programs exist. (Knapp-USGS)
W70-00999

CONSTRUCTION OF A MULTILEVEL SCHEME STABLE IN RELATION TO INITIAL DATA FOR SHORT-RANGE WEATHER FORECAST (RUSSIAN),
For primary bibliographic entry see Field 02B.
W70-01015

STATISTICAL STRUCTURE OF VERTICAL HUMIDITY PROFILES (RUSSIAN),
For primary bibliographic entry see Field 02B.
W70-01016

ADAPTION OF AIR TEMPERATURE FIELD TO WATER TEMPERATURE FIELD (RUSSIAN),
N. T. Glinskiy, V. F. Baklanovskayaya, and R. D. Gasanova.
Izvestia Akad Nauk, SSSR, Fizika Atmosfery i Okeana, Vol 4, No 11, p 1214-1219, Nov 1968. 5 fig, 13 ref.

Descriptors: *Air temperature, *Water temperature, Mathematical studies, Mapping, Atmosphere, Air circulation, Water circulation, Seasonal, Turbulence, Heat exchangers, Radiation, Winds, Density, Velocity.
Identifiers: North Atlantic, Air-water temperature relations.

The relationship between air temperature and water temperature was investigated on the basis of the solution of a second order partial differential equation applied to the selected meteorological and hydrological data collected in the North Atlantic, assuming that the coefficients of turbulence of each air layer are constant. The propagation of a temperature disturbance in water and the air takes place with equal velocity, indicating that the temperature changes in an over-the-water air layer closely follow the water temperature changes. (Gabriel-USGS)
W70-01017

NONLINEAR THEORY OF WIND DRIFT OF ICE (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02C.
W70-01018

2B. Precipitation

MEASURING RAINFALL ON FOREST CATCHMENTS,
Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering.
R. J. DeLaine.
J Hydrol, Vol 9, No 1, p 103-112, Sept 1969. 10 p, 1 fig, 3 ref.

Descriptors: *Rainfall, *Rain gages, *Networks, Stemflow, Interception, Forests, Instrumentation, Runoff forecasting, Rainfall-runoff relationships.
Identifiers: Forested catchments, Rain gaging.

Some principles based on field experience are given for planning a network of rain gages to give the greatest amount of information for a given amount of effort and equipment. Several ways of measuring rainfall above and below trees are described. In forest country where gaging is difficult, or in steep open country, or for any long term project, it is better to start with a pilot survey, using about 30% to 40% of the gages. This will give an idea of the variations in rainfall over the area, and will provide useful information to position the remaining gages. (Knapp-USGS)
W70-00843

A MODEL FOR RAINFALL ROUTING DURING INITIAL ABSTRACTION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 02A.
W70-00844

SEASONAL VARIATION IN RAIN GAGE CATCH,
Agricultural Research Service, Cochocton, Ohio. Soil and Water Conservation Research Div.; and Weather Bureau, Akron, Ohio. Eastern Region.
J. L. McGuinness, and Grant W. Vaughn.
Water Resources Res, Vol 5, No 5, p 1142-1146, Oct 1969. 5 p, 2 fig, 2 tab, 11 ref.

Descriptors: *Rain gages, *Lysimeters, Seasonal, Rainfall, Precipitation (Atmospheric), Calibrations, Climates, Meteorology, Interception, Ohio.
Identifiers: Rain gage catch variations.

In northern Ohio 8-inch standard rain gages consistently caught more precipitation in summer and less in winter than adjacent digital punch gages although average annual totals were almost identical. A similar seasonal pattern was found in a comparison of precipitation catch by weighing lysimeters and adjacent weighing-type recording rain gages in Ohio and in a comparison of standard and recording rain gage catch in Nebraska. Some reasons for the differences in their implications are discussed. (Knapp-USGS)
W70-00854

CONTINUOUS HYDROGRAPH SYNTHESIS WITH AN API-TYPE HYDROLOGIC MODEL,
Weather Bureau, Silver Spring, Md.
For primary bibliographic entry see Field 02A.
W70-00860

ON THE POSSIBILITY OF ESTIMATING THE THICKNESS OF UNCONSOLIDATED ROCKS BY VERTICAL ELECTRICAL SOUNDING IN PERMAFROST AREAS (RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Geofizicheskikh Metodov Razedki, Moscow (USSR).
For primary bibliographic entry see Field 07B.
W70-00878

THE CLIMATE OF CITIES: A SURVEY OF RECENT LITERATURE,
National Air Pollution Control Administration, Raleigh, N.C.
For primary bibliographic entry see Field 10.
W70-00988

CONSTRUCTION OF A MULTILEVEL SCHEME STABLE IN RELATION TO INITIAL DATA FOR SHORT-RANGE WEATHER FORECAST (RUSSIAN),
V. M. Kadyshnikov.
Izvestia Akad Nauk, SSSR, Fizika Atmosfery i Okeana, Vol 4, No 11, p 1139-1148, Nov 1968. 3 fig, 17 ref.

Descriptors: *Weather forecasting, *Mathematical models, Temperature, Gravity, Atmospheric pressure, Atmosphere, Mathematical studies, Altitude, Mapping, Cyclones, Anticyclones.
Identifiers: Multilevel-pattern numerical weather forecasting.

By assuring quasi-static and adiabatic conditions, hydrodynamic equations are given. Atmospheric geopotentials and temperatures are a function of velocity, gravity, atmospheric pressure, and gas constant. To achieve reliable short-range weather forecasting, the atmospheric space was subdivided into n layers and certain end conditions were assumed. The application of the Taylor series and matrix techniques leads to final results which can be evaluated by solving the Laplace and Helmholtz equations. An example is given of surface pressure forecasting by means of a S-level prognostic pattern satisfying the necessary requirements. (Gabriel-USGS)
W70-01015

STATISTICAL STRUCTURE OF VERTICAL HUMIDITY PROFILES (RUSSIAN),
V. S. Komarov.
Izvestiga Akad Nauk, SSSR, Fizika Atmosfery i Okeana, Vol 4, No 11, p 1160-1168, Nov 1968. 2 tab, 14 ref.

Descriptors: *Humidity, *Atmosphere, *Mathematical models, Statistical models, Seasonal, Meteorology, Forecasting, Heat balance, Energy budget, Altitude, Temperature, Geophysics, Radiosondes.
Identifiers: *USSR.

The mean values, standard deviations, and autocorrelation functions of the vertical structure of the humidity fields at Voyeykovo Tashkent, Kzyl-Orda and Nagayevo of the USSR were evaluated on the basis of radiosonde data and the application of statistical and matrix methods. The effect of physico-geographical and seasonal factors on the autocorrelation function characteristics is briefly analyzed. (Gabriel-USGS)
W70-01016

WEATHER PATTERNS IN SOUTHERN WEST PAKISTAN,
Clark Univ., Worcester, Mass. Graduate School of Geography.
Rodman E. Snead.
Available from the Clearinghouse as AD-685 975, $3.00 in paper copy, $0.65 in microfiche. Archiv fur Meteorologie, Geophysik und Bioklimatologie, ser B, Vol 16, p 316-346, 1968. 31 p, 7 fig, 7 tab, 42 ref.

Descriptors: *Arid lands, *Meteorology, *Weather patterns, *Meteorological data, Anticyclones, Precipitation (Atmospheric), Synoptic analysis, Seasonal, Rainfall disposition, Storms, Monsoons, Convection.
Identifiers: *West Pakistan, *Subsidence (Atmospheric), Arabian Sea, Depressions (Atmospheric).

The region studied is of particular interest as a transition zone between the mediteranean type winter rainfall to the west and monsoon summer rainfall to the east. As a result Southern West Pakistan receives scanty, unreliable rainfall averaging less than 10 inches per year, resulting in a very arid land. Six main patterns of weather were identified and the reasons for their occurrence are described using a method of synoptic comparison of the characteristics associated with each weather type. The types are: subtropical anticyclone pattern, winter cyclone storms, modified monsoon pattern, and eastern depressions. The synoptic characteristics of each are presented. Located in a transition zone between these different patterns, the area receives only the dying effects of each. The author concludes that it is remarkable that any moisture reaches the area since subtropical, anticyclone air is not conducive to the upward movement and resulting condensation of moisture. (Crouse-Arizona)
W70-01197

NOCTURNAL AIR TEMPERATURE ON A FORESTED MOUNTAIN SLOPE,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
James D. Bergen.
USDA Forest Serv Res Pap RM-52, 1969. 12 p, illus.

Descriptors: *Air temperature, *Mountain forests, *Climatology, Isotherms, Microclimatology, Forestry, Nocturnal temperatures, Meteorology, Heat budget, Thermodynamics, Frost protection, Cooling.
Identifiers: *Forest temperatures.

Profiles of air temperature on a forested mountain slope show an inversion below the top of the tree canopy. The slope tends to cool with constant downslope temperature gradient in the early part of the night; gradients increase in the later hours. Plots of potential temperature indicate, for some nights, a point of almost constant temperature halfway up the hillside. This point can be identified with a center of divergence for cold air moving off the slope. The potential temperature deficit relative to the temperature at this point shows approximate similarity between vertical profiles at the different stations when the profiles are scaled by the height of the first inversion above the slope and the average potential temperature deficit below that inversion.
W70-01219

SOME OBSERVATIONS OF CLOUD INITIATION IN INDUSTRIAL AREAS,
Public Health Service, Washington, D.C.
For primary bibliographic entry see Field 05C.
W70-01240

2C. Snow, Ice, and Frost

TOTAL ALBEDO OF GREAT LAKES ICE,
United States Lake Survey, Detroit, Mich.
S. J. Bolsenga.
Water Resources Res, Vol 5, No 5, p 1132-1133, Oct 1969. 2 p, 1 tab, 6 ref.

Descriptors: *Albedo, *Ice, *Great Lakes, *Lake ice, Slush, Climatology.
Identifiers: Brash ice, Pancake ice.

The total (0.3-3.0 micron) albedo of various types of ice common to the Great Lakes ranged from 10% for clear ice to 46% for snow ice at solar altitudes ranging from 32 to 40 degrees. Explanations are given for similarities between the albedo of pancake (31%) and slush curd ice (32%), and slush (41%) and brash ice (41%). (Knapp-USGS)
W70-00851

WATER TEMPERATURE DURING THE MELTING OF LAKE ICE,
National Research Council of Canada, Ottawa (Ontario).

For primary bibliographic entry see Field 02H.
W70-00852

GLACIAL HISTORY AND MORPHOLOGY OF WEST SWEDEN (SWEDISH),
Lund Univ. (Sweden). Geographical Inst.
Ake Hillefors.
Summaries of each section of text are given in English. Medd Fran Lunds Univ Geogr Inst, Avhandlingar No 60, 1969. 319 p, 214 fig, 1 map, 410 ref.

Descriptors: *Glaciation, *Glaciers, *Geomorphology, Geology, Animal populations, Plant populations, Ice, Ice breakup, Till, Stratigraphy, Marine geology, Deltas, Climates, Radioactive dating, Erosion, Sediment transport, Rocks.
Identifiers: *Sweden, West Sweden glaciated area.

A comprehensive study is compiled of the glacial history and morphology of the West Sweden area based on the author's field work and 410 earlier publications. The discussion includes: (1) rocks and morphology; (2) the Dosebacka formations (inner construction and genesis); (3) ice movements in West Sweden; (4) the moraine (Forms, inner construction, and probable genesis); (5) the glaciofluvial material (morphology, inner construction, and probable genesis); (6) studies of the marine limit; (7) the ice recession; and (8) the late-glacial climate of West Sweden. (Gabriel-USGS)
W70-00998

CERTAIN ASPECTS OF ENGINEERING GEOLOGY IN PERMAFROST,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 08D.
W70-01011

NONLINEAR THEORY OF WIND DRIFT OF ICE (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
D. L. Laykhtman.
Izvestia Akad Nauk, SSSR, Fizika Atmosfery i Okeana, Vol 4, No 11, p 1220-1224, Nov 1968. 2 fig, 1 tab, 5 ref.

Descriptors: *Ice, *Drifting (Aquatic), *Wind velocity, *Mathematical models, *Mathematical studies, Velocity, Stress, Turbulent flow, Viscosity, Roughness coefficient, Roughness (Hydraulic).
Identifiers: Ice drift (Wind-driven).

The phenomenon of wind drift of ice was analytically investigated using an ice-motion equation, assuming certain limiting conditions. With the increase of the Rossby number for the upper surface of the ice, the wind coefficient is increased. If the ratio of the upper roughness to the lower roughness increases, the coefficient of roughness increases. Ice drift deviates from an isobar up to 50% in the direction of higher pressure, with the small deviation angles associated with the large Rossby numbers. (Gabriel-USGS)
W70-01018

STRENGTH TEST ON NEWLY FALLEN SNOW,
Forest Service (USDA), Salt Lake City, Utah. Alta Avalanche Study Center.
For primary bibliographic entry see Field 07B.
W70-01221

2D. Evaporation and Transpiration

A NUMERIC METHOD FOR ESTIMATING INFILTRATION, REDISTRIBUTION, DRAINAGE, AND EVAPORATION OF WATER FROM SOIL,
Utah State Univ., Logan; Illinois Univ., Urbana; and Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02G.
W70-00862

AN EMPIRICAL METHOD FOR ESTIMATING MONTHLY POTENTIAL EVAPOTRANSPIRATION IN NEVADA,
Agricultural Research Service, Fresno, Calif. Soil and Water Conservation Research Div.; and Nevada Univ., Reno. Desert Research Inst.
Jerold J. Behnke, and George B. Maxey.
J Hydrol, Vol 8, No 4, p 418-430, Aug 1969. 13 p, 4 fig, 3 tab, 11 ref.

Descriptors: *Evaporation, *Nevada, Arid lands, Lysimeters, Estimating, Evaporation pans, Climates, Topography, Weather, Solar radiation, Evapotranspiration.
Identifiers: Thornthwaite evapotranspiration.

Monthly potential evapotranspiration values were obtained for several stations throughout the State of Nevada using the Thornthwaite and Olivier equations. The Olivier equation correlated well with lysimeter and adjusted pan data as an estimate of ET. On an annual basis the Thornthwaite equation was approximately 50% too low. A technique was developed to estimate wet bulb depression from temperature data. This made it possible to solve the Olivier equation using only temperature data as imput. Climatic conditions in Nevada were such that it was possible to apply the dry adiabatic lapse rate to a centrally located base station to obtain temperature values for other locations lacking climatic data. On a monthly basis, this 'modified' Olivier equation correlated satisfactorily with the original equation for Nevada locations ranging in elevation from 2171 to 5136 ft and in latitude from 36 deg to 41 deg N. (Knapp-USGS)
W70-01004

2E. Streamflow and Runoff

A LABORATORY STUDY OF SURFACE RUNOFF DUE TO MOVING RAINSTORMS,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02A.
W70-00839

AN ESTIMATION OF WIND EFFECTS ON DISPERSION IN WIDE CHANNELS,
Hydronautics, Inc., Laurel, Md.
Jin Wu.
Water Resources Res, Vol 5, No 5, p 1097-1104, Oct 1969. 7 p, 5 fig, 1 tab, 9 ref. OWRR Proj C-1290.

Descriptors: *Dispersion, *Winds, *Open channel flow, *Mixing, Waste dilution, Turbulence, Diffusion, Steady flow, Convection.
Identifiers: Turbulent shear flow.

The longitudinal dispersion coefficient in a wide channel is calculated under various combinations of streamflow and wind conditions. The effect of wind, which produces drift currents in the stream, on dispersion has hitherto been neglected. The results obtained, especially the difference in dispersion coefficients obtained under upstream and downstream wind conditions, may partially explain the wide scatter of field data. This difference further indicates the importance of choosing the ejection site on the basis of the prevailing wind conditions and of considering environmental conditions beyond stream factors alone. (Knapp-USGS)
W70-00842

A MODEL FOR RAINFALL ROUTING DURING INITIAL ABSTRACTION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 02A.
W70-00844

EFFECT OF RAINFALL VARIABILITY ON STREAMFLOW SIMULATION,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 02A.
W70-00850

FLOOD PLAIN INFORMATION, TROUT AND BIJOU CREEKS, SOUTH LAKE TAHOE, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W70-00856

CONTINUOUS HYDROGRAPH SYNTHESIS WITH AN API-TYPE HYDROLOGIC MODEL,
Weather Bureau, Silver Spring, Md.
For primary bibliographic entry see Field 02A.
W70-00860

A STUDY OF HOT WIRE AND HOT FILM ANEMOMETERS IN WATER (FRENCH),
Centre National de la Recherche Scientifique, Marseille (France); and Aix-Marseille Univ. (France). Institut de Mecanique des Fluides.
For primary bibliographic entry see Field 07B.
W70-00868

NON-LINEAR FREE SURFACES IN OPEN CHANNELS (FRENCH),
Centre National de la Recherche Scientifique, Chatillon-sous-Bagneux (France). Centre de Calcul Analogique.
For primary bibliographic entry see Field 08B.
W70-00871

PROPAGATION OF WAVE-FRONTS IN WIDE CHANNELS OF ARBITRARY CROSS-SECTION,
Leeds Univ. (England).
For primary bibliographic entry see Field 08B.
W70-00872

A WATER YIELD MODEL DERIVED FROM MONTHLY RUNOFF DATA,
Office of Tributary Area Development, Knoxville, Tenn.
For primary bibliographic entry see Field 03B.
W70-00905

NATURAL FEATURES CAUSED BY A CATASTROPHIC STORM IN NELSON AND AMHERST COUNTIES, VIRGINIA,.
Department of Conservation and Economic Development, Richmond, Va. Div. of Mineral Resources.

Virginia Minerals, Spec Issue, Oct 1969. 19 p, 28 fig, 1 map, 3 ref.

Descriptors: *Storms, *Virginia, *Appalachian Mountain Region, *Hurricanes, *Damages, Erosion, Floods, Landslides, Disasters, Storm runoff, Rain.
Identifiers: Hurricane Camille (1969).

Torrential rains associated with hurricane Camille dumped up to 27 inches of water during the night of Aug. 19-20, 1969 on portions of Nelson, Amherst, and adjoining counties, Virginia. The severe storm centered in the headwaters of the Tye and Rockfish Rivers and their tributaries. Abnormal amounts of rainfall have been reported from the Clifton Forge area in the western portion of the State, eastward. Considerable rain fell on the western slope of the Blue Ridge in the South River watershed. All the above mentioned streams are in the James River basin, and the flood damage extended through Richmond, eastward. Massive landslides of the debris-avalanche type moved soil, boulders, and trees to create chutes and channels that extend from the foot of the steep mountainous slopes to the mountain crests. Alluvial, rubble, and debris fans were formed, and extreme high water occurred in the lower reaches of the valleys to cause extensive property damage and loss of life. Dr. John T. Hack, U.S. Geological Survey, concluded that severe rainstorms are recurring

phenomena and are an important factor in the erosion and formation of the central Appalachian mountain landscape. (Knapp-USGS)
W70-00992

STORAGE YIELD: EXTENDING THE SEQUENT PEAK ALGORITHM TO MULTIPLE RESERVOIRS,
Water Resources Engineers, Inc., Springfield, Va.
For primary bibliographic entry see Field 06A.
W70-01000

EFFECT OF CHANGES OF STREAMFLOW REGIMEN ON RESERVOIR YIELD,
State Univ. of New York, Syracuse. Water Resources Center.
For primary bibliographic entry see Field 04A.
W70-01001

MEASUREMENT OF COLUMBIA RIVER FLOW TIME FROM HANFORD REACTORS TO ASTORIA, OREGON-SUMMER 1966,
Oregon State Univ., Corvallis.
Peter J. Hanson, and William O. Forster.
Water Resources Res, Vol 5, No 5, p 1129-1131, Oct 1969. 3 p, 1 fig, 6 ref.

Descriptors: *Streamflow, *Tracers, *Columbia River, *Tracking techniques, Chromium, Discharge (Water), Path of pollutants, Radioactive wastes, Waste dilution, Sampling.
Identifiers: Chromium radioisotopes, Water-mass tracers.

Chromium-51 induced in the Hanford production reactors was used to measure Columbia River flow times between the reactors and Astoria, Oregon. This opportunity came during the summer of 1966 when all reactors were inoperative for the first time in 22 yr. Chromium-51, introduced into the river as chromate anion tends to remain in solution, thus providing a suitable water-mass tracer. The complex inverse relationship of flow time to volume discharge is seen in our values of 12 days flow time from the reactors to Astoria, Oregon, during an average discharge of 290,000 cfs and 19 days flow time at a low volume discharge of 13,000 cfs. Such short travel time could be critical in the event of an accidental release into the river of extremely hazardous levels of radioactivity. (Knapp-USGS)
W70-01002

SPATIALLY VARIED FLOW EQUATIONS,
Illinois Univ., Urbana.
Ven Te Chow.
Water Resources Res, Vol 5, No 5, p 1124-1128, Oct 1969. 5 p, 5 ref.

Descriptors: *Overland flow, *Mathematical studies, Steady flow, Unsteady flow, Discharge (Water), Mathematical models, Open channel flow, Equations, Hydrodynamics.
Identifiers: Spatially varied overland flow.

The momentum and energy principles are equally applicable in the derivation of spatially varied flow equations. By applying the energy principle and introducing a slope of given energy head, the resulting spatially varied flow equation takes a different form of several terms containing the slope and the effect of added or extracted discharge from the equation derived by applying the momentum principle and using the frictional slope. The two slopes, however, become identical if the flow is steady. The spatially varied flow equation is the same for flow with either increasing or decreasing discharge. (Knapp-USGS)
W70-01003

FREQUENCY DISTRIBUTIONS OF STREAM LINK LENGTHS,
Princeton Univ., N.J. Dept. of Statistics.
For primary bibliographic entry see Field 02J.
W70-01006

THE LAKE MISSOULA FLOODS AND THE CHANNELED SCABLAND,
Chicago Univ., Ill. Dept. of the Geophysical Sciences.
For primary bibliographic entry see Field 02J.
W70-01012

STOCHASTIC METHODS FOR ANALYZING RIVER BASIN SYSTEMS,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
For primary bibliographic entry see Field 06A.
W70-01085

FREQUENCY ANALYSES OF FLOODS AND DROUGHTS,
Irrigation and Water Supply Commission, Queensland.
J. K. G. Ward.
Inst Eng, Aust Civ Eng Trans, Vol CE 10, No 1, p 7-14, Apr 1968. 8 p, 6 fig, 4 tab, 25 ref, disc.

Descriptors: Reservoirs, Reservoir storage, Streamflow, Foreign design practices, Streamflow forecasting, *Flood forecasting, Flood peaks, Peak discharge, Flood hydrographs, *Floods, *Droughts, Statistical analysis, Probability, Drainage basins, River flow, Hydrology, Bibliographies.
Identifiers: *Flood frequency, Flood hydrology, *Drought frequency curves, Australia.

Probability analysis of floods and droughts is of uncertain usefulness because of the unpredictability of sample errors and scarcity of field data. However, probability studies provide a valuable addition to hydrologic assessments and should be used whenever possible. A method is presented for statistical analysis of floods and droughts for rivers having reasonably long streamflow records. Results of these analyses can be applied to ungaged streams for flood frequency predictions. Flood probability predictions on ungaged catchment areas must be used with extreme caution because parameters identifying the similarity of catchment areas are difficult if not impossible to define. If used with caution, the method can provide valuable results and allow preliminary hydrologic estimates for feasibility studies of proposed dams. Drought analyses give additional data for storage behavior, assessing desirability of constructing a reservoir, issuing stream pumping licenses, and indicating low flow periods for construction purposes. (USBR)
W70-01120

INCREASES IN MAXIMUM STREAM TEMPERATURES AFTER SLASH BURNING IN A SMALL EXPERIMENTAL WATERSHED,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07C.
W70-01220

2F. Groundwater

GROUNDWATER MOVEMENT TOWARD ARTIFICIAL CUTS,
North Carolina State Univ., Raleigh.
Abdel-Aziz I. Kashef.
Water Resources Res, Vol 5, No 5, p 1032-1040, Oct 1969. 9 p, 3 fig, 2 tab, 11 ref.

Descriptors: *Groundwater movement, *Saturated flow, *Steady flow, *Excavation, Drainage, Water table, Water levels, Aquifers, Hydraulic conductivity, Aquicludes, Seepage, Inflow.
Identifiers: Drainage to excavations.

Artificial cuts, such as open channels and highway cuts, produce an imbalance in the original groundwater system. The developed drawdowns due to these cuts under the condition of saturated steady flow are studied theoretically by analyzing the seepage through trapezoidal sections of earth entailing the complexity of the free surface. The procedure is then extended to actual cases of extensive aquifers where such cuts exist. The proposed method is compared with some of the available rigorous mathematical solutions, such as those given by Falkovich, Mikhailov, Meletchenko, Pavlovsky, and Polubarinova-Kochina. The proposed method is simpler in its application and also gives a complete solution for the free surface, the discharge face, the rate of flow, and the hydropotential distribution within the affected region, whereas the rigorous methods are planned essentially for the solution of the free surface only. (Knapp-USGS)
W70-00858

DETERMINING AQUIFER CHARACTERISTICS BY THE TIDAL METHOD,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
P. A. Carr, and G. S. Van Der Kamp.
Water Resources Res, Vol 5, p 1023-1031, Oct 1969. 9 p, 2 fig, 3 tab, 7 ref.

Descriptors: *Transmissivity, *Permeability, *Aquifers, *Tidal effects, Aquicludes, Water storage, Hydraulic conductivity, Artesian wells, Water level fluctuations, Hydrogeology.
Identifiers: Aquifer testing, Tidal efficiency, Prince Edward Island (Canada).

If groundwater levels of a confined aquifer fluctuate with sea tides, individual values of hydraulic conductivity and specific storage can then be determined. Apparent tidal efficiency and time lag are first calculated from the water level data recorded at an observational device situated inland from the sea, taking into account the response characteristics of the observational device. The true tidal efficiency of the aquifer at the seacoast is then determined from the apparent tidal efficiency and used to obtain the specific storage. This and the tidal time lag are utilized to calculate the hydraulic conductivity. The method was tested in Prince Edward Island, Canada, and yielded results compatible with pump test data. This is a simple and inexpensive way to test a confined aquifer in the coastal environment. (Knapp-USGS)
W70-00859

MOVEMENT OF DDT AND NITRATES DURING GROUND-WATER RECHARGE,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05B.
W70-00861

ON THE HYDROGEOLOGY OF THE CENTRAL AND NORTHWESTERN PART OF THE DNIEPER-DONETS ARTESIAN BASIN (UKRAINIAN),
Kharkov State Univ., (USSR).
For primary bibliographic entry see Field 02K.
W70-00866

A SCHEME OF GEOTHERMAL WATERS OF CENTRAL ASIA (RUSSIAN),
Sredneaziatskii Nauchno-Issledovatelskii Institut Geologii i Mineralnogo Syria, Tashkent (USSR).
B. A. Beder.
Me'ruzeler Doklady, Akad Nauk Azerbaidzh, SSR, Vol 25, p 34-38, 1969. 1 fig.

Descriptors: *Groundwater, *Aquifers, *Thermal water, Heat flow, Mineral water, Industrial water, Water temperature, Altitude, Reservoir storage, Artesian wells, Geology, Boreholes, Water yield, Mapping.
Identifiers: *USSR, *Central Asia.

A detailed map shows the distribution of 30 artesian and other basins in Central Asia using data compiled in earlier geological and geophysical studies and published deep borehole data. Central Asia may be considered one of the USSR's richest territories in hydrothermal resources. (Gabriel-USGS)
W70-00869

ROLE OF PROGNOSIS OF GROUNDWATER STATE IN PROJECTION OF DAMS (POLISH),
For primary bibliographic entry see Field 08A.
W70-00874

THE WATER-TABLE AQUIFER IN THE EASTERN COASTAL AREA OF BELGIUM,
Rijksuniversitair Centrum te Antwerpen (Belgium); and Ghent Rijksuniversiteit (Belgium).
W. De Breuck, and G. De Moor.
Bull Int Ass Sci Hydrol, Vol 14, No 3, p 137-155, Sept 1969. 19 p, 14 fig, 2 tab, 22 ref.

Descriptors: *Aquifers, *Coastal plains, *Exploration, *Electrical studies, Surveys, Water quality, Conductivity, Resistivity, Water resources development, Water levels, Water chemistry.
Identifiers: *Belgium, Groundwater prospecting.

A resistivity survey using the Wenner arrangement has been conducted in the water-table aquifer in the eastern part of the Coastal Area of Belgium. Bore holes have been drilled to test the geoelectrical data and also to collect water samples. The chemical characteristics and the distribution of different water types explain the hydrochemistry of the water-table aquifer. The fresh-brackish-water boundary as determined by the resistivity survey has been expressed in terms of total dissolved-solids content. (Knapp-USGS)
W70-00986

RECORDS OF SELECTED WELLS AND SPRINGS IN THE RULISON PROJECT AREA, GARFIELD AND MESA COUNTIES, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07C.
W70-00987

GROUNDWATER IN SANTA BARBARA COUNTY, CALIFORNIA, SPRING 1967 TO SPRING 1968,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07C.
W70-00989

ON A SOIL AND GROUND WATER INVESTIGATION WITH THE SHALLOW REFRACTION METHOD AT MO I RANA,
Terratest A.B., Bromma (Sweden); and Swedish Geotechnical Inst., Stockholm.
For primary bibliographic entry see Field 07B.
W70-00995

AN INEXPENSIVE SHALLOW WATER TABLE PROBE,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 07B.
W70-00996

WATER-RETENTION CHARACTERISTICS OF COARSE ROCK PARTICLES,
Khartoum Univ. (Sudan). Dept. of Geology; and Missouri Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 02G.
W70-00997

LAND SUBSIDENCE DUE TO GROUNDWATER WITHDRAWAL, TULARE-WASCO AREA, CALIFORNIA,
Geological Survey, Washington, D.C.
B. E. Lofgren, and R. L. Klausing.
Geol Surv Prof Pap 437-B, p B1-B101, 1969. 101 p, 69 fig, 15 tab, 54 ref.

Descriptors: *Subsidence, *Compaction, *Water level fluctuations, *Withdrawal, *California, Groundwater, Water yield, Water wells, Geology, Hydrogeology, Instrumentation, Surveys.
Identifiers: Tulare-Wasco area (Calif).

Intensive pumping of groundwater has caused more than 800 sq mi of irrigable land to subside in the Tulare-Wasco area, San Joaquin Valley, Calif. Locally, groundwater levels declined as much as 200 ft between 1905 and 1964, and the maximum subsidence was about 12 ft by 1964. Subsidence was due to the compaction of the water-yielding deposits as the intergranular effective stresses increased. The magnitude and rate of subsidence are directly related to (1) the change in effective stress within the various compacting beds that results from water-level changes and (2) the thickness and compressibility of the compacting deposits. The compressibility of the deposits can be approximated either by testing selected cored samples in the laboratory or by measuring in the field the compaction that results from a given change in effective stress in a subsiding area. The annual rate of subsidence varies greatly in direct response to seasonal pumping. This rate varied from an average of about 136,000 acre-ft per year from 1948 to 1954, to 45,000 acre-ft per year from 1957 to 1959, and to 173,000 acre-ft per year from 1959 to 1962. During the 13 years from 1950 to 1962, the volume of subsidence (1.40 million acre-ft) was roughly 10% of the total groundwater pumpage (13.5 million acre-ft). (Knapp-USGS)
W70-01013

ON THE PRESENT OPTIMUM VARIANT IN HYDROGEOLOGICAL EXPLORATION (GERMAN),
Central Geological Inst., Berlin (East Germany).
For primary bibliographic entry see Field 07C.
W70-01022

TIME VARIANT GROUND WATER FLOW BY RESISTANCE NETWORK ANALOGUES,
Birmingham Univ. (England). Dept. of Civil Engineering.
Robin Herbert.
J Hydrol, Vol 6, No 3, p 237-264, 1968. 28 p, 17 fig, 2 tab, 12 ref.

Descriptors: *Groundwater movement, *Model studies, *Analytical techniques, Water table, Analog models, Steady flow, Storage capacity, Permeability, Dewatering, Drawdown, Hydrologic properties, Flow nets.
Identifiers: *Unconfined flow, Network analogs, Time variant flow, Inertia forces.

A technique is presented for studying time variant unconfined groundwater flow using resistance network analogs. Development of the technique is described first and then it is tested against three analytical solutions to aquifer systems of two dimensional, radial, and three dimensional forms. Testing shows the technique to be accurate and it can be extended to represent any geometric flow net. The method can be used to study three dimensional groundwater flow such as determination of the principles on which to design multi-well dewatering systems. Water-table movement and steady state conditions are shown graphically. Demonstration problems and a comparison of water-table profiles are also graphed. (Lang-USGS)
W70-01039

GENERAL SYSTEMS APPROACH TO GROUND-WATER PROBLEMS,
Arizona, Tucson.
Lucien Duckstein, and Chester C. Kisiel.
Proc Ser No 5, Proc Nat Symp Analysis Water-resour Syst, p 100-115, July 1968. 16 p, 60 ref.

Descriptors: *Groundwater, Reviews, Bibliographies, *Systems analysis, Input-output analysis, Optimum development plans, Aquifers, Mathematical analysis, *Mathematical models, Economics, Dynamic programming, Ecology, Groundwater mining, Numerical analysis, Groundwater recharge, Operations research, Economic justification.
Identifiers: Systems engineering, Problem solving, Hydrologic models, Black box analysis, Well yield, *Groundwater management.

A summary of the state of the art in ground-water systems analysis is presented. Scope of the paper is a combination of concepts from general systems theory, operations research, human factors (economics and social sciences), engineering mathematics, probability and statistics, numerical analysis, and computer sciences woven onto a fabric of classical and modern hydrology. Future strategies for management of the ground-water system must be mixed. Proposed management models require extensive evaluation in a real-world context. Orderly control of withdrawals will be needed to avoid local depletion. Contamination resulting from encroachment of water from the sea or from portions of an aquifer containing saline water must be prevented as well as contamination by indiscriminate deep disposal of waste waters. Ecology as the science of interrelationships must be considered. Economic consequences of ecological factors should be treated as a social cost. Modern developments in systems analysis can sharpen professional judgment and decisions in managing ground-water systems. The formalism and classification outlined are suggested as a complement to the intuitive judgment of professionals having extensive experience in ground-water systems. (USBR)
W70-01123

SUBSURFACE FLOW REGIMES OF A HYDROLOGIC WATERSHED MODEL,
Department of Agriculture, Beltsville, Md.
C. A. Onstad, and D. G. Jamieson.
Second Seepage Symposium, Proceedings, Phoenix, Arizona, Mar 25-27, 1968. Agricultural Research Service, Washington, DC, ARS 41-147, 1969. 10 p, 9 fig, 11 ref.

Descriptors: *Subsurface flow, *Base flow, *Storage coefficient, *Reservoir storage, Watersheds (Basins), Return flow, Hydrology, Groundwater, Groundwater flow, Hydrographs, Groundwater movement, Rainfall-runoff relationships, Seepage, Simulation, Rainfall, Parametric hydrology, Overland flow, Runoff, Infiltration, Outflows.
Identifiers: *Hydrologic models, *Runoff hydrographs.

Historically, separation of baseflow from the total hydrograph was arbitrarily performed under various concepts. All traditional methods of baseflow separation terminate at a nebulous point on the hydrographic recession limb where the flow is assumed to be baseflow. In addition, the assumption is made that the peak baseflow is somehow connected to an identifiable point on the surface runoff hydrograph. The former assumption is subjective; the latter is usually unrealistic. In contrast, the model presented attempts to simulate objectively various subsurface flow regimes. Despite the necessity of inferring the inputs to the various flow regimes, the model is realistic, using only the measured response of each flow regime. The purpose of the model is to separate baseflow from the total hydrograph and to simulate and later synthesize the land phase of the hydrologic system. The model possesses thresholds that make the system nonlinear, but linear reservoir theory is applicable above the thresholds. Few parameters must be derived by iteration since the majority are inserted as measurable quantities. The system is flexible--reservoirs can be added, subtracted, or combined, depending upon the response of the particular watershed. (USBR)
W70-01237

2G. Water in Soils

STEADY FLOW OF WATER THROUGH A TWO-LAYER SOIL,
Iowa State Univ., Ames.

Sam-Arnq Srinilta, D. R. Nielsen, and Don Kirkham.
Water Resources Res, Vol 5, No 5, p 1053-1063, Oct 1969. 11 p, 17 fig, 1 tab, 14 ref.

Descriptors: *Soil water movement, *Anisotropy, *Steady flow, Darcy's law, Hydraulic conductivity, Pore pressure, Sorption, Particle size, Clays, Unsaturated flow, Hysteresis.
Identifiers: Layered soils.

A laboratory study of water moving steadily through an isothermal two-layer soil was analyzed by using Darcy's equation for unsaturated flow. Factors considered were thickness and kinds of topsoil, depth of surface water ponding, magnitude of outflow water pressure, and soil water history of the profile. Soil water pressure distributions were measured at 5-cm depth intervals along the vertical columns. The unsaturated hydraulic conductivity was measured for sorption and desorption for each of four soils used as topsoil and subsoil in the two-layer columns. Values of hydraulic conductivity as a function of soil water pressure were used to predict the measured soil water pressure distributions and steady state fluxes. The agreement between predicted and measured profiles is exceptionally close. The necessity of distinguishing between sorption and desorption, of obtaining a uniform soil bulk density distribution within each soil layer, and of ascertaining the hydraulic conductivity as a function of soil water pressure is discussed in relation to the predicted soil water pressure distribution and flux values. (Knapp-USGS)
W70-00840

HYDROSTATICS AND HYDRODYNAMICS IN SWELLING SOILS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. R. Philip.
Water Resources Res, Vol 5, No 5, p 1070-1077, Oct 1969. 8 p, 1 fig, 42 ref, append.

Descriptors: *Soil water movement, *Expansive soils, *Expansive clays, Darcy's law, Hydraulic conductivity, Hydrodynamics, Consolidation, Unsteady flow, Steady flow, Unsaturated flow, Infiltration, Diffusion.
Identifiers: Soil water hydrodynamics, Moisture gradients.

The generalization to swelling soils of the mathematical theory of water movement in unsaturated soils involves the following extensions to the classic analysis: (1) recognition that Darcy's law applies relative to the soil particles, (2) inclusion of the void ratio function in the characterization of the soil, and (3) reconsideration of hydrostatics in swelling media. For swelling soils the total potential includes an additional component, the overburden potential, evaluation of which leads to the condition for equilibrium in the vertical, which is a first order linear differential equation with singular coefficients. Three types of equilibrium profile follow: hydric profiles with moisture gradient less than 0, pycnotatic profiles with gradients of 0, and xeric profiles with gradients greater than 0. Other phenomena in swelling soils treated include steady vertical flows and unsteady horizontal and vertical flows. Classic concepts of groundwater hydrology, tacitly based on the behavior of nonswelling media, fail completely for swelling soils. The approach also provides a theory of consolidation which includes the influences of (1) soil particle movement, (2) unsaturation, and (3) self-weight. (Knapp-USGS)
W70-00841

A NUMERIC METHOD FOR ESTIMATING INFILTRATION, REDISTRIBUTION, DRAINAGE, AND EVAPORATION OF WATER FROM SOIL,
Utah State Univ., Logan; Illinois Univ., Urbana; and Colorado State Univ., Fort Collins.
R. J. Hanks, A. Klute, and E. Bresler.
Water Resources Res, Vol 5, No 5, p 1064-1069, Oct 1969. 6 p, 7 fig, 4 ref.

Descriptors: *Soil water movement, *Infiltration, *Percolation, *Drainage, *Evaporation, Hysteresis, Unsaturated flow, Numerical analysis, Digital computers, Profiles, Hydraulic conductivity.
Identifiers: Soil water redistribution.

A general numeric method is described for estimating one-dimensional infiltration, redistribution, evaporation, and drainage of water from soil. The type of flow is determined by the water flux at the surface of soil or the bottom boundary. The method provides for hysteresis in the water content - pressure head relation. Comparison with measurement made on soil columns for infiltration, redistribution, and evaporation were made. Good agreement was obtained between measured and computed values. (Knapp-USGS)
W70-00862

SOIL MOVEMENT ON IRREGULAR SLOPES,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02J.
W70-00864

TEMPORAL, HORIZONTAL AND VERTICAL VARIABILITY OF WATER CHEMISTRY IN UNSATURATED ZONE OF FINE-GRAINED SOILS,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W70-00911

WATER-RETENTION CHARACTERISTICS OF COARSE ROCK PARTICLES,
Khartoum Univ. (Sudan). Dept. of Geology; and Missouri Univ., Columbia. Dept. of Geology.
Ismail M. El Boushi, and Stanley N. Davis.
J Hydrol, Vol 8, No 4, p 431-441, Aug 1969. 11 p, 7 fig, 1 tab, 4 ref.

Descriptors: *Water storage, *Infiltration, *Recharge, *Gravels, *Specific retention, Percolation, Unsaturated flow, Rainfall-runoff relationships, Surface-groundwater relationships, Wetting, Wettability, Surfaces, Saturation.
Identifiers: Rock rubble.

Water is retained on large particles of non-porous rock as a film of water about 0.1 mm thick on rock surfaces, as 0.006 to 0.180 ml droplets held at contact points between adjacent particles, and as small puddles of water on the upper surfaces of the rock. Water retained at contact points accounts for most of the water stored within aggregates of particles with diameters smaller than 30 mm. Whereas with diameters larger than 100 mm, water retained on the rock surfaces, particularly water puddled on top of the rock, accounts for most of the water. Infiltrating water will not wet all the rock surfaces. More than 50% of the surfaces may be dry at depth. The total amount of rainfall needed to initiate groundwater recharge in many areas having coarse rock particles at the surface is probably less than 1.0 cm. (Knapp-USGS)
W70-00997

2H. Lakes

TOTAL ALBEDO OF GREAT LAKES ICE,
United States Lake Survey, Detroit, Mich.
For primary bibliographic entry see Field 02C.
W70-00851

WATER TEMPERATURE DURING THE MELTING OF LAKE ICE,
National Research Council of Canada, Ottawa (Ontario).
G. P. Williams.
Water Resources Res, Vol 5, No 5, p 1134-1138, Oct 1969. 5 p, 4 fig, 2 tab, 8 ref.

Descriptors: *Water temperature, *Lake ice, *Melting, Climates, Albedo, Solar radiation, Energy budget.
Identifiers: *Canada, Ontario, White Lake, Ice thickness.

Water temperature and ice thickness were measured during the ice melt period at Bennett Bay, White Lake, Ontario. Water temperatures were as high as 7.5 deg C under the melting ice cover. The heat needed to warm the water under the ice and to melt ice at the ice-water interface was calculated for different periods and compared with the heat available from solar radiation that penetrated the ice cover. It was concluded from these calculations that solar radiation penetrating the ice caused the relatively high water temperatures observed under the melting ice. (Knapp-USGS)
W70-00852

NEW THERMAL INVESTIGATION OF LAKES TRAUHSEE AND FUSCHLSEE (IN GERMAN),
O. Eckel.
Verh Internat Verein, Limnol, XIV, Stuttgart, p 70-78, July 1961.

Descriptors: *Lakes, *Thermal properties, *Stratification, Epilimnion, Hypolimnion, Thermocline, Temperature, Wind velocity, Meteorological data.

Investigations of thermal changes in various depths of two lakes in Austria proved the dependence of water temperature fluctuation in all layers on meteorological conditions. It was stated that the mutual dependence between the motion of water, wind, and temperature distribution exists. It was also stated that the water in deeper layers is always in motion even if the water surface of a lake is quiescent. The investigated temperature fluctuations were either periodical or non-periodical. The former had 24-hour periods and the latter were caused by wind effects. Periodical wind formation caused an occurrence of free currents in both lakes. The total movement of water particles in all layers of a lake were found to be the vector summation of wind effects and inert waves. The influence of warm storm air on temperature change was most remarkable in the deeper layers (differences up to 2C in a 50 m deep layer in comparison with 0.3C in the surface layer). (Novotny-Vanderbilt)
W70-00886

A STOCHASTIC APPROACH TO THE DEVELOPMENT OF A REGULATION PLAN FOR THE GREAT LAKES,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch; and McGill Univ., Montreal (Quebec).
R. H. Clark, and G. S. Cavadias.
Proc, Int Hydrol Symp, Vol 1, Colo State Univ, p 430-442, Sept 1967. 13 p, 8 fig, 4 tab, 4 ref.

Descriptors: *Stochastic processes, *Great Lakes, *Simulation analysis, *Optimization, *Water resources development, Navigation, Hydroelectric power, Operating costs, Water control, Water levels, Synthetic hydrology.
Identifiers: Multivariate model.

A progress report was given on research results of a joint United States-Canadian regulation study for the Great Lakes. The objective of the study was to establish a regimen of lake levels and outflows which would maximize the benefits and minimize the detriments equitably among all interests. Navigation was best served by high lake levels, hydro-power generation by maintenance of minimum flows as large as feasible, while shore property interests benefited most by reductions in the extremes of both high and low lake levels. Computer simulation techniques were used both for generating and testing artificial flow sequences and for determining the consequences of various operating plans. The multivariate model proposed by Fiering was used in the simulation and the sequences generated were subjected to several tests

order to verify whether properties of the ecorded supplies were conserved. The regulation lan was considered as a sequence of decisions nder uncertainty with the testing record generated y a stochastic process. (Thiuri-Cornell)
V70-00902

LIMNOLOGICAL COMPARISON OF TWO MALL IDAHO RESERVOIRS,
daho Univ., Moscow. Dept. of Biological Sciences.
ary W. Miller, and Fred W. Rabe.
ydrobiologia, Vol 33, No 3-4, p 523-544, July 22, 969. 22 p, 12 fig, 4 tab, 38 ref.

escriptors: *Limnology, *Idaho, *Reservoirs, ampling, Physicochemical properties, Zooplank-n, Nannoplankton, Productivity, Mapping, nalytical techniques, Water level fluctuations, Vater temperature, Heat budget, Organic matter, ydrogen, Carbon dioxide, Seasonal.
dentifiers: Reservoir limnology.

hysicochemical characteristics of the water, ooplankton, and nannoplankton concentrations of vo Idaho reservoirs were investigated by using hemical analysis, electronic thermometers, a ecchi disk, and C-14 isotope methods. No well-efined thermocline can be identified in Deep reek or Crowthers Reservoir. Annual heat budget estimated to be about 15,000 cal/sq cm for both eservoirs, with low dissolved oxygen concentra-ons on the bottom during the summer months. oth reservoirs are alkaline with pH ranging from .5 to 8.9. The mean summer primary production ates of nannoplankton were 9.9 mg cu m/hr and .7 mg cu m/hr for the Crowthers and for the Deep reek Reservoirs, respectively. The biomass of etrital heterotrophs was highest in the Crowthers eservoir. (Gabriel-USGS)
V70-01005

DIAGENETIC CHANGES IN INTERSTITIAL VATERS OF HOLOCENE LAKE CONSTANCE EDIMENTS,
leidelberg Univ. (West Germany). Sediment Lab.
erman Muller.
lature, Vol 224, p 258-259, Oct 1969. 2 p, 2 fig, 5 ef.

escriptors: *Water chemistry, *Diagenesis, Lakes, Sedimentation, Fresh water, Chemical eactions, Mineralogy, Clays, Organic matter, iodegradation, Sedimentation rates.
dentifiers: *Lake Constance, *Switzerland.

Vater samples from cones taken from the bottom f Lake Constance, Switzerland were analyzed. In ne fresh water sediments of the lake the pore water s changed considerably after entrapment so that it s no longer similar to the lake water. The sulfate ontent is entirely removed, chlorine is depleted, nd Na, K, Mg, silica, nitrogen, phosphorus, and icarbonate are considerably increased by reac-ons between water and minerals and by organic ecay. (Knapp-USGS)
V70-01009

TRONTIUM-90 CONCENTRATION FACTORS OF LAKE PLANKTON, MACROPHYTES, AND UBSTRATES,
kademiya Nauk URSR. Inst. of Biology of the outhern Seas.
or primary bibliographic entry see Field 05C.
V70-01010

EASONAL CHARACTERISTICS OF TWO ALINE LAKES IN WASHINGTON,
Vashington Univ., Seattle. Dept. of Zoology.
. C. Anderson.
imnology and Oceanography, Vol 3, p 51-68, 958. 6 fig, 4 tab, 21 ref.

escriptors: *Saline lakes, *Washington, Seasonal, *Limnology, *Arid lands, Phytoplank-on, Distribution, Sampling, Temperature, Oxygen, Hydrogen ion concentration, Alkalinity, Phosphates, Chlorophyll, Shallow water, Nutrients, Diatoms, Depth, Biota, Meromixis, Zooplankton, Calcium, Magnesium, Sodium, Potassium, Carbonates, Sulfates, Bicarbonates, Chlorides, Nitrates, Outlets, Evaporation, Runoff, Hydrogen sulfide, Stratification, Diatoms, Spores, Rotifers, Cyanophyta, Chrysophyta, Chlorophyta.
Identifiers: Morphometric conditions, Transparency, Lake Lenore (Wash), Amphora, Chaetoceros elmorei, Soap Lake (Wash), Monimolimnion, Dictichlis stricta, Mixolimnion, Scirpus nevadensis, Juncus bufonius, Asterionella formosa, Cyclotella, Eunotia, Fragilaria crotonensis, Melosira distans, Navicula, Nitzschia, Tabellaria flocculosa, Gloeocystis, Oscillatoria, Spirulina major, Ceratoneis, Cladocera, Lake volume.

Limnology of two saline lakes in Washington was studied in relation to physical and chemical conditions influencing growth and distribution of phytoplankton. The lakes were sampled at frequent intervals for more than a year, between 1950 and 1951. Morphometric conditions were determined, and routine sampling included measurements of temperature, transparency, oxygen, pH, alkalinity, phosphate, chlorophyll, and quantitative samples of phytoplankton. Lake Lenore, the less saline of the two (total dissolved solids, 14 grams/liter), is shallow and was unstratified during the investigation. Dissolved nutrients were high and varied erratically during summer. The taxonomically simple phytoplankton population is comprised mainly of two species of diatoms--Amphora sp, which forms the spring bloom, and Chaetoceros elmorei, which constitutes the late summer bloom. Soap Lake is relatively deep, meromictic, and saline (total dissolved solids, 35 grams/liter). Temperature conditions are dichothermic, and nutrient content high, especially in the monimolimnion. A winter maximum and summer minimum in the phytoplankton population was observed and a change in the biota during dilution of the lake in recent years is described. There are indications that phytoplankton is grazed by zooplankton in both lakes. (Jones-Wisconsin)
W70-01076

SOME LIMNOLOGICAL FEATURES OF A SHALLOW SALINE MEROMICTIC LAKE,
Washington Univ., Seattle. Dept. of Zoology.
G. C. Anderson.
Limnology and Oceanography, Vol 3, p 259-270, 1958. 6 fig, 4 tab, 16 ref.

Descriptors: *Limnology, *Arid lands, *Saline lakes, *Meromixis, *Shallowwater, Washington, Magnesium compounds, Temperature, Chara, Cyanophyta, Sulfur bacteria, Zooplankton, Gypsum, Hydrogen ion concentration, Oxygen, Dissolved solids, Light penetration, Depth, Volume, Runoff, Seasonal, Hydrogen sulfide, Solar radiation, Evaporation, Heating, Light intensity, Chlorides, Bicarbonates, Sodium, Rotifers, Copepods, Aerobic conditions, Thermal stratification, Lake morphology.
Identifiers: Kruger Mountain (Wash), Hot Lake (Wash), Oroville (Wash), Distichlis spicata, Artemia salina, Transparency, Morphometry, Lake area, Monimolimnion, Vertical, Mixolimnion, Chemocline, Chlorobium, Salt gradient, Bottom waters, Heat gain, Heat loss, Mineral analyses, Plectonema nostocorum, Oscillatoria chlorina, Anacystis thermalis, Gomphosphaeria aponina, Brachionus angularis, Keratella quadrata, Ostracod, Branchinecta, Epsom salt.

Seasonal variations of some physical, chemical, and biological features were studied from December 1954 to October 1956 in Hot Lake, a shallow saline body of water occupying a former epsom salt excavation in north central Washington. Since it has neither an inlet nor outlet, evaporation is important. The lake is meromictic, and, during the period of study, had an average salt gradient of approximately 100 grams per liter (g/l) at the surface to 400 g/l at the bottom, the major salt being magnesium sulfate. The mixolimnion was thin enough that the monimolimnion was heated directly by the sun, with resulting temperatures in excess of 50 deg C recorded in the monimolimnion during summer. The mixolimnion was transparent; the monimolimnion, opaque. Much of this heat was retained during the winter. The calculated value of heat gain in the monimolimnion agreed well with observed values. The flora consisted mainly of Chara, a bottom mat of blue-green algae, and a dense population of green sulfur bacteria in the upper part of the monimolimnion. Artemia salina was the dominant zooplankter, and some features of its life history, as affected by the unusual thermal properties of the lake, are described. (Jones-Wisconsin)
W70-01077

ABOUT THE QUESTION OF VERTICAL MIXING OF WASTE WATERS IN CLOSED RESERVOIRS (In Russian),
For primary bibliographic entry see Field 05B.
W70-01078

LIMNOLOGICAL EFFECTS OF ORGANIC EXTRACTS OF LITTER IN A SOUTHWESTERN IMPOUNDMENT,
Arizona Univ., Tucson; and Arizona Cooperative Fishery Unit, Tucson.
William J. McConnell.
Limnology and Oceanography, Vol 13, No 2, p 343-349, Apr 1968. 1 fig, 4 tab, 16 ref.

Descriptors: *Limnology, *Organic matter, *Impoundments, *Arizona, Biomass, Carbohydrate, Epilimnion, Hypolimnion, Watershed, Ecology, Lakes, Secondary productivity, Pass, Food chains, Microorganisms, Snails, Zooplankton, Fish, Harvesting.
Identifiers: Phenolics, Xenopus laevis, Micropterus salmoides, Litter (Forest), Pena Blanca Lake (Ariz), Quercus emoryi, Quercus oblongifolia, Ecological efficiencies, Production (Fish), Harvest (Fish).

Torrential rains in July, following dry winters and springs, cause considerable quantities of litter from the watershed to be deposited into impoundments in southeastern Arizona, with subsequent limnological consequences. Author describes limnological effects of oak litter extracts, the dominant evergreen, in Pena Blanca Lake which received 750 grams/square meter of litter during summer of 1959. Cold-water extracts of oak litter reveal that carbohydrates and phenolics were the major soluble compounds. Glucose was the predominant sugar. Presence of an unidentified compound was suggested as postulated to be an organic acid. Growth rates of larval Xenopus laevis were significantly increased by addition of oak leaves to the environment. Estimated production during 1959 of trophically similar animals attributed to litter import was 2.35 grams biomass/square meter. (Daniel-Wisconsin)
W70-01080

2I. Water in Plants

ESTIMATES OF PERIPHYTON MASS AND STREAM BOTTOM AREA USING PHOSPHOROUS-32,
Oak Ridge National Lab., Tenn. Radiation Ecology Section.
D. J. Nelson, N. R. Kevern, J. L. Wilhm, and N. A. Griffith.
Water Research, Vol 3, No 5, p 367-373, May 1969. 7 p, 1 tab, 15 ref.Res sponsored by U.S. Atomic Energy Comm under contract with Union Carbide Corp.

Descriptors: *Periphyton, *Phosphorous radioisotopes, *Biomass, *Analytical techniques, Channel morphology, Sediments, Sorption, Radioactivity techniques, Biota, Hydraulic properties, Roughness (Hydraulic).
Identifiers: *Periphyton mass measurement, Bottom surface (Streams).

A rapid method is given for determining the biomass of periphyton and the bottom surface area of a small rocky stream by using P-32. About 75% of the introduced P-32 was retained within a 100 m study area. Periphyton on artificial substrate sorbed 254 times more P-32 than sediments and 48 times more than leaves. The absorption of P-32 was also measured for natural substrata. Uptake appeared to be a surface phenomenon. Total standing crop in the test area was calculated to be 1.5 kg. The bottom area was found to be 560 sq m, about four times larger than estimated by usual surface measurements. In view of the irregular topography of the stream bottom, the value obtained from uptake of P-32 requires better estimation of the total bottom area than available from surface measurements. The technique is adaptable to shallow streams where periphyton is a major component of the biota. The technique can be used for measurement of surface areas for uneven stream channels and hydraulic parameters such as bed roughness. (Carstea-USGS)
W70-00846

NET RADIATION IN A RIPARIAN MESQUITE COMMUNITY,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
J. M. Tromble, and J. R. Simanton.
Water Resources Res, Vol 5, No 5, p 1139-1141, Oct 1969. 3 p, 1 fig, 6 ref.

Descriptors: *Solar radiation, *Mesquite, *Arid lands, Energy budget, Energy, Albedo, Meteorology.
Identifiers: Net radiation.

Net radiation patterns for a riparian mesquite community are similar to net radiation patterns obtained for a humid forest. The net radiation peak of the open area was 61% of the net radiation peak above the canopy. The net radiation within a mesquite canopy peaked 9% higher but had a lower daily total value than the radiation above the canopy. The differences in net radiation peaks were attributed to differences in the canopy geometry, solar position, and surface reflectance, whereas differences in daily net radiation were attributed to differences in surface reflectance characteristics. (Knapp-USGS)
W70-00853

THE DEVELOPMENT AND DISTRIBUTION OF PLANKTON IN THE NORTHERN PART OF THE WHITE NILE,
Khartoum Univ. (Sudan). Dept. of Zoology.
Y. B. Abu Gideiri.
Hydrobiologia, Vol 33, No 3-4, p 369-378, July 22, 1969. 10 p, 7 fig, 7 ref.

Descriptors: *Plankton, *Rivers, *Plant growth, *Water quality, Plant populations, Sampling, Electrical conductance, Biology, Water chemistry, Oxygen, Ions, Chlorides, Sulfates, Crustaceans, Seasonal, Organic matter, Temperature, Alkalinity.
Identifiers: *Sudan, White Nile.

The plankton population of the White Nile was investigated by analyzing samples from three stations located along the 45 km course of the river and using the results of earlier publications. The study shows the presence of two yearly plankton growth peaks whose development and distribution are correlated with environmental conditions such as transparency, temperature, dissolved gases, nutrients, pH, alkalinity, conductivity, etc. Rotifers outnumber crustaceans at the Morgan sampling station and are at equilibrium at Jebel Aulia. The presence of Tropodiaptomus processifer, T. Kraepelini, T. Orientalis, Brachionus caudatus, Anabaenopsis circularis, and Closterium bibleinii at the Morgan sampling station indicates the effect of the Blue Nile waters on the White Nile. (Gabriel-USGS)
W70-01007

EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS: SIGNIFICANCE OF EXTERNAL WATER-POTENTIAL AND SALT-TRANSPORT KINETICS ON RATE OF CELL EXPANSION,
California Univ., Riverside.
J. J. Oertli.
Soil Science, Vol 105, No 4, 1968, p 216-222. 7 p, 2 fig, 18 ref.

Descriptors: *Salinity, *Saline soils, *Soil-water-plant relationships, *Plant physiology, *Plant growth, Osmotic pressure, Turgidity, Xylem, Kinetics, Cytological studies.
Identifiers: *Turgor pressure, Salt transport.

Soil salinity generally results in a reduction of plant growth. This report theoretically investigates the effect of external salt concentration and of the solute transport on cell elongation. When internal hydrostatic pressure exceeds external pressures, plant cells elongate. If water transport into the cell occurs in response to salt addition to the vacuole, the rate-limiting factor is probably the salt, and not the water transport. Solute requirement is a function of total water potential at the root surface. Salt transport rates depend upon external concentration and obey kinetics of decreasing efficiency. The cell elongation rate depends upon external concentration; the time for unit elongation decreases, passes through a minimum and subsequently increases in the range of saline conditions. Experimental support of the conclusions will be presented in a subsequent paper. (Crouse-Arizona)
W70-01214

2J. Erosion and Sedimentation

ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION, 1963-65, UNITED STATES AND CANADA.
Engineering-Science, Inc., Los Altos, Calif.

For sale by the Superintendent of Documents, US Government Printing Office, Wash, DC 20402, price $4.50. Joint Hydrol-Sedimentation Bull No 9, Inter-Agency Comm on Water Resources, June 1969. 527 p.

Descriptors: *Bibliographies, *Water resources, *Hydrology, *Sedimentation, Abstracts, Documentation, Sediment transport, Groundwater movement, Hydrogeology, Hydraulics, Open channel flow, Water law, Water management (Applied).
Identifiers: Hydrology and sedimentation bibliography.

The Hydrology and Sedimentation Committees, Water Resources Council, have sponsored this Bibliography as a guide to literature on hydrology and sedimentation for the use of Government agencies and the public. Every effort has been made to cover all such literature published in the United States and Canada during 1963-1965. The index of the bibliography covers both place and subject. In the United States and Canada, the smallest geographical subdivisions used are states and provinces. Elsewhere, geographical subdivision is by country. For papers applying to areas larger than the smallest subdivision, entries are listed under major river basins in the United States and by continents for the rest of the world. In general, listings in the index are primary. (Knapp-USGS)
W70-00837

MODIFIED RUBEY'S LAW ACCURATELY PREDICTS SEDIMENT SETTLING VELOCITIES,
Texas Univ., Austin.
Richard L. Watson.
Water Resources Res, Vol 5, No 5, p 1147-1150, Oct 1969. 4 p, 2 fig, 1 tab, 3 ref.

Descriptors: *Settling velocity, *Equations, *Particle size, *Particle shape, *Analytical techniques, Viscosity, Reynolds number, Deposition (Sediments), Suspension.
Identifiers: Settling tubes, Sediment analyzers.

Modification of viscous drag and the pressure drag terms in Rubey's theoretic equation for settling velocity of sand grains with two empirically determined constants results in a formula which predicts accurately the settling velocity of groups of sand grains measured with the woods Hole rapid sediment analyzer. This modified formula can now be used for calculation of particle size with fall time data from the sediment analyzer. The advantage of this method rather than the use of empiric data for particle size determination is that the determination can be made regardless of the water temperature in the settling tube, the viscosity of the fluid in the tube, or the relative densities of the fluid and the particles, as long as these values are known. (Knapp-USGS)
W70-00855

USE OF MEMBRANE FILTERS IN GRAVIMETRIC ANALYSES OF PARTICULATE MATTER IN NATURAL WATERS,
Dartmouth Coll., Hanover, N. H.; and Yale Univ., New Haven, Conn.
For primary bibliographic entry see Field 07B.
W70-00857

SOIL MOVEMENT ON IRREGULAR SLOPES,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div.
Robert A. Young, and Calvin K. Mutchler.
Water Resources Res, Vol 5, No 5, p 1084-1089, Oct 1969. 6 p, 2 fig, 4 tab, 11 ref.

Descriptors: *Soil erosion, *Model studies, *Simulated rainfall, Gully erosion, Rill erosion, Sheet erosion, Runoff, Slopes, Topography, Soil conservation, Rainfall intensity, Tracers, Dye releases.
Identifiers: Soil erosion test plots, Soil movement tracers.

Soil loss and runoff were measured from concave, uniform, and convex slopes subjected to simulated rainfall. Fluorescent glass particles and microrelief measurements were used to determine soil movement patterns in the slopes. For slopes of equal average steepness, a concave shape greatly reduced the total sediment loss in comparison with that from either a uniform or convex slope. Average slope steepness was not a good indicator of soil delivery past a given point except for a uniform slope. In general, soil losses from irregular slopes depend on the steepness of a short section of that slope immediately above the point of measurement. Soil movement off the plots was primarily transport by raindrop splash to a rill system and then transport down the slope by runoff in the rill system. A breakdown of the rill system occurred on the bottom of the concave slopes because of decreasing local steepness, resulting in sheet flow and sediment deposition. (Knapp-USGS)
W70-00864

RELATIVE DENSITY EFFECTS ON INCIPIENT BED MOVEMENT,
Minnesota Univ., Minneapolis.
Bruce D. Ward.
Water Resources Res, Vol 5, No 5, p 1090-1096, Oct 1969. 7 p, 4 fig, 2 tab, 10 ref.

Descriptors: *Bed load, *Sediment transport, Tractive forces, Shear stress, Shear drag, Mathematical studies, Density, Model studies, Hydraulic models, Turbulence, Turbidity.
Identifiers: Bed load movement, Stress analysis.

The Shields entrainment function, extrapolated from bed load movement to predict the threshold of particle motion, appears deficient in analyzing incipient shear data for fluid-sediment combinations encompassing a wide range of relative densities. Equations describing incipient dynamic equilibrium, solved semiempirically, indicate addi-

ional density considerations that must be included n an attempt to correlate initial movement for all ossible sedimentation density ratios. This and ther experimental investigations also indicate any ntrainment function to be independent on the tate of the bed and corresponding turbulence. Other factors which might be influential on the hreshold of particle movement are mentioned. (K-app-USGS)
W70-00865

FLUORESCENT SAND AS A TRACER OF FLUVIAL SEDIMENT,
Geological Survey, Menlo Park, Calif.
Vance C. Kennedy, and Dorothy L. Kouba.
Geol Surv Open-file Rep, 1968. 53 p, 14 fig, 4 tab, 21 ref.

Descriptors: *Sediment transport, *Tracers, *Fluorescence, *On-site tests, Sedimentary rocks, Rivers, Sands, Sampling, Petrology, Mapping, Discharge measurement, Mathematical studies, Suspended load, Currents (Water), Velocity, Streamflow.
Identifiers: *Fluvial sediments, Fluorescent sand tracer.

A description is given of on-site tests to evaluate use of the fluorescent sand method as a means of measuring sediment discharge in a gravel-bed stream. Stream sand coated with fluorescent paint was added at a constant known rate to Clear Creek at Golden, Colorado, during a 28-hour period and the concentration of fluorescent grains was recorded at a site 810 meters downstream from the point of introduction. First-arrival time of fluorescent sand was correlated with the square of grain diameter for particles in the range of 0.15-0.86 mm. Complete lateral mixing of fluorescent sand was not achieved within the study reach, but steady-state conditions apparently were achieved for the finer particles. The lateral mixing of coarser grains was found to be much better than that for finer grains. Sediment discharge computed from the tracer dilution method was about 30% greater than the suspended-sediment discharge computed for suspended samples of the 0.15-0.18 mm range and about 200% greater for the 0.38-0.52 mm range. (Gabriel-USGS)
W70-00867

GLACIAL HISTORY AND MORPHOLOGY OF WEST SWEDEN (SWEDISH),
Lund Univ. (Sweden). Geographical Inst.
For primary bibliographic entry see Field 02C.
W70-00998

FREQUENCY DISTRIBUTIONS OF STREAM LINK LENGTHS,
Princeton Univ., N.J. Dept. of Statistics.
W. R. James, and W. C. Krumbein.
Office of Naval Research Contract Nonr-1228 (36), ONR Task No 389-150. J Geol, Vol 77, No 5, p 544-565, Sept 1969. 22 p, 9 fig, 6 tab, 14 ref.

Descriptors: *Topography, *Drainage patterns (Geologic), *Streams, *Statistical models, Drainage density, Tributaries, Markov processes, Stochastic processes, Networks, Regional analysis.
Identifiers: *Drainage basin morphology, Drainage net topology.

Theories of drainage basin topology are reviewed and compared, and a new theoretical analysis is offered. Analysis of interior links in a magnitude 1311 basin shows that the probability of successive tributaries entering main channels from the same side is only about two-thirds the probability of opposite-side entry. These higher-order structures in the data (the spatial arrangement of successive tributaries) display a first-order Markovian property in sequences of link type. These structures are examined in their substantive context, and a composite gammalike population density for interior link lengths is developed theoretically. This density contains the higher-order structures and agrees, at least approximately, with observed relations in main channels of magnitude 10 or greater. (Knapp-USGS)
W70-01006

DIAGENETIC CHANGES IN INTERSTITIAL WATERS OF HOLOCENE LAKE CONSTANCE SEDIMENTS,
Heidelberg Univ. (West Germany). Sediment Lab.
For primary bibliographic entry see Field 02H.
W70-01009

THE LAKE MISSOULA FLOODS AND THE CHANNELED SCABLAND,
Chicago Univ., Ill. Dept. of the Geophysical Sciences.
J. Harlen Bretz.
J Geol, Vol 77, No 5, p 505-543, Sept 1969. 39 p, 10 fig, 2 plate, 2 tab, 53 ref.

Descriptors: *Geomorphology, *Topography, *Floods, *Pleistocene epoch, *Columbia River, Oregon, Washington, Montana, Idaho, Erosion, Historic flood, Deposition (Sediments), Discharge (Water), Sedimentary structures, Sedimentation, Channel morphology.
Identifiers: Channeled Scablands.

This paper reviews the outstanding evidence for repeated catastrophic outbursts of Montana's glacially dammed Lake Missoula. Flooding consequently overwhelmed in many places the preglacial divide along the northern margin of the Columbia Plateau in Washington. The plateau's preglacial drainage pattern was remade into an anastomosing complex of floodwater channels (Channeled Scabland) locally eroded hundreds of feet into underlying basalt. These flood-born rivers converged into the Columbia Valley at least as far as Portland, Oregon, depositing a huge delta at Portland. Evidence that the major scabland rivers and the flooded Columbia were hundreds of feet deep exists in: gravel and boulder bars more than 100 ft high in mid-channels; subfluvial cataract cliffs, alcoves, and plunge pools hundreds of feet in vertical dimension; back-flooded silts high on slopes of preglacial valleys tributary to the scabland complex; and the delta at Portland. Climatic oscillations of the Cordilleran ice sheet produced a succession of Lake Missoulas. The Montana glacial record has been correlated with recurrent scabland floods by soil profiles and a glacial and loessial stratigraphy, and some events have been approximately dated by volcanic ash layers, peat deposits, and an archaeological site. (Knapp-USGS)
W70-01012

FORMATION OF HYDROXY-AL AND -FE INTERLAYERS IN MONTMORILLONITE AND VERMICULITE: INFLUENCE OF PARTICLE SIZE AND TEMPERATURE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W70-01014

THE VOLUME AND CHARACTER OF SILTING-SEDIMENTATION OF THE SIONI RESERVOIR (RUSSIAN),
G. S. Metrebeli.
Soobshchenie Akademii Nauk Gruzinskoi SSR, Vol 52, No 3, p 689-694, Dec 1968. 2 fig, 1 tab, 4 ref.

Descriptors: *Reservoir silting, *Water storage, *Silting, Rivers, Discharge (Water), Runoff, Water level fluctuations, Sedimentation rates, Geology, Organic matter, Solid wastes, Mathematical studies, Forecasting, Landslides.
Identifiers: *USSR, Sioni reservoir.

Silting of the Sioni reservoir, USSR, was investigated on the basis of geological and hydrological data recorded in 1963 to 1967. The sedimentary layer thicknesses vary from zero to 1.2 m. During 4 years of the existence of the reservoir the Iory River brought in 960,000 cu m of solid material in addition to 130,000 cu m brought in by minor streams. In general the silting can be considered as of minor importance because the bottom sediments can be easily transferred into the lower reaches of the Iory River by using suitable mechanical devices. (Gabriel-USGS)
W70-01019

THE ANALYSIS AND CLASSIFICATION OF SLOPE PROFILE FORMS,
Sheffield Univ. (England). Dept. of Geography.
R. A. G. Savigear.
Evolution Des Versants, Proc Symp de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 271-272, 1967. 2 p, 5 fig, 3 ref.

Descriptors: *Geomorphology, *Slopes, *Classification, *Profiles, *Terrain analysis, Mapping, Erosion, Surveys, Analytical techniques, Land forming, Topography, Sedimentation.
Identifiers: England, Slope profiles.

A classification of slope profiles is developed on the basis of data recorded at the seaward slopes in Cornwall, Southwestern England. The classification is of morphological character which essentially differs from earlier classifications of geomorphogenetic character. The techniques are intended to provide methods by which the recognition of the form elements of a profile may be investigated and objectively defined. The study contains the following topics: classification problems related to the selection and survey of profiles; methods of analysis and classification; measured length profile; the intercept profile; the unit profile; a classification of unit relationship; and a classification of unit groups. (Gabriel-USGS)
W70-01040

THE DYNAMICS OF QUATERNARY SLOPE EVOLUTION AND ITS GEOMORPHOLOGICAL REPRESENTATION,
M. Pecsi.
Evolution Des Versants, Proc Symp de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 187-199, 1967. 13 p, 6 fig, 1 tab, 2 ref.

Descriptors: *Dynamics, *Slopes, *Aeolian soils, *Erosion, *Quaternary period, Glaciation, Climates, Sedimentation, Freezing, Topography, Geology, Clays, Loess, Sands, Gravels, Solifluction, Mass wasting, Deposition (Sediments).
Identifiers: *Hungary, Danube basin, Slope evolution.

The stratigraphy of thick layers of Pleistocene loess of the Central Danube basin was investigated to determine the processes of formation of Quaternary slopes. The sedimentary layers of the hillslopes are well to poorly stratified and consist of aeolian loess, sands, and fossil-bearing soils. Subaerial stream erosion alternated with the processes of deposition; however, in many places the changes in the slope curvatures completely obliterated the high intensity processes of earlier accumulation and deposition. Cryogenic processes acted in different combinations, with different intensity and efficiency on different parts of the slopes, in function of the lithology, slope angle, exposure and, in general, of local biogeographical, morphological and microclimatical conditions. (Gabriel-USGS)
W70-01041

PLEISTOCENE ACTIVITY AND HOLOCENE STABILITY OF HILLSLOPES, WITH EXAMPLES FROM SCANDINAVIA AND PENNSYLVANIA,
Anders Rapp.
Evolution Des Versants, Proc Symp de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 229-244, 1967. 16 p, 5 fig, 1 tab, 14 ref.

Descriptors: *Erosion, *Slopes, *Slope stability, *Solifluction, *Pleistocene epoch, *Pennsylvania, Quaternary period, Glaciation, Geology, Altitude, Climates, Soils, Humidity, Mapping, Vegetation, Sediments, Mass wasting.
Identifiers: Scandinavia, Hillslopes.

A quaternary glaciated area of Sweden and a non-glaciated area of Pennsylvania were investigated for the evaluation of the stability of hillslopes. The studies conducted in Sweden show that the ice-lake shore lines at Lake Grovelsjon have been only very slightly deformed in 8000 years, indicating that solifluction, creep, and gullying can be rather weak, even on slopes of considerable inclination. Slopes with relatively high silt soil content are subject to much stronger processes of solifluction and mass wasting. The study of the Appalachian ridges of Pennsylvania indicates efficient mass wasting during cold Pleistocene tundra conditions and stability of slopes during the Holocene. In the evaluation of slope stability in the Pennsylvania area, it was assumed that the boulder strips are of the particular diagnostic value for this purpose. (Gabriel-USGS)
W70-01042

SOIL SLIPPAGE: AN INDICATOR OF SLOPE INSTABILITY ON CHAPARRAL WATERSHEDS OF SOUTHERN CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Robert G. Bailey, and Raymond M. Rice.
Professional Geographer, Vol 21, No 3, May 1969, p 172-177. 6 p, 2 fig, 7 ref.

Descriptors: *Semiarid climates, *Chaparral, *Slope stability, *Accelerated erosion, *California, Root zone, Soil physical properties, Vegetation effects, Erosion, Landslides, Watersheds (Basins).
Identifiers: *Slippage.

Soil slips, small landslides involving only the material above the unweathered bedrock surface, are characteristic of the young, steep mountains of semiarid southern California and are a major erosional agent. The slips, associated with occassional intense high volume storms, strip substantial areas of soil and vegetative cover, causing downstream damage and adversely affecting local water supply. A study of slips on the San Dimas Experimental Forest showed that slope was the most important site characteristic associated with soil slips. The immediate slope on slips occurred was never less than 80%. Other important factors included the density and rooting depth of vegetative cover, soil physical properties, and soil depth (shallow soils were more likely to slip). In one storm slip erosions produced 81 cubic yds. per acre on slopes converted to shallow rooted grasses, whereas in adjacent deep-rooted chaparral areas 11 cubic yds. were eroded. (Crouse-Arizona)
W70-01196

SHEETFLOODS, STREAMFLOODS, AND THE FORMATION OF PEDIMENTS,
Connecticut Univ., Storrs.
Perry H. Rahn.
American Association of Geographers, Annals, Vol 57, No 3, Sept 1967, p 593-604. 12 p, 2 tab, 16 fig, 20 ref.

Descriptors: *Arid lands, *Geomorphology, *Erosions, *Sheet floods, *Floods, Streamflow, Arizona, Supercritical flow, Geologic formations, Rainfall-runoff relationships, Hydrology.
Identifiers: *Pediments, *Bahadas.

Four summer floods were observed in the arid southern Arizona basin and range country. All were confined to pediments or bahadas. Two characteristics of storm runoff were noted. Floods near or on pediments exhibited supercritical flow and were termed streamfloods. Thunderstorm runoff on the bahadas manifested itself as sheet floods. Land surface of the pediments was found to be dissected by gullies, whereas bahadas nearer the center of the basins were of smoother, rolling topography. (Crouse-Arizona)
W70-01211

2K. Chemical Processes

ON THE HYDROGEOLOGY OF THE CENTRAL AND NORTHWESTERN PART OF THE DNIEPER-DONETS ARTESIAN BASIN (UKRAINIAN),
Kharkov State Univ., (USSR).
G. M. Zakjarchenko, and V. P. Litvinov.
English summary. Dopovidi Akad Nauk, Ukr, RSR, Ser B, Geol, Geofis, Khim, and Biol, No 7, p 582-586, 1969. 1 fig, 2 tab.

Descriptors: *Hydrogeology, *Groundwater basins, *Artesian wells, *Water chemistry, Aquifers, Boreholes, Stations, Sampling, Mapping, Sodium, Potassium, Carbonates, Chlorides, Magnesium, Salinity.
Identifiers: *USSR, Ukraine, Dnieper-Donets artesian basin.

Chemical composition of the Dnieper-Donets artesian basin water was analyzed by taking water samples at 13 localities. The 5 water types detected are: calcium bicarbonate, calcium-sodium-bicarbonate-sulfate, sodium bicarbonate, sodium chloride, and bicarbonate-sodium-chloride. (Gabriel-USGS)
W70-00866

THE RELATION OF ION MOVEMENT TO FINE PARTICLE DISPLACEMENT IN A SAND BED,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 05B.
W70-00909

TEMPORAL, HORIZONTAL AND VERTICAL VARIABILITY OF WATER CHEMISTRY IN UNSATURATED ZONE OF FINE-GRAINED SOILS,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W70-00911

DISTINGUISHING MARINE AND FRESH-WATER MUDS,
Illinois Geological Survey, Urbana; and Indiana Univ., Bloomington.
N. F. Shimp, J. Witters, Paul Edwin Potter, and J. A. Schleicher.
J Geol, Vol 77, No 5, p 566-580, Sept 1969. 15 p, 4 fig, 7 tab, 14 ref.

Descriptors: *Geochemistry, *Mud, *Clays, *Adsorption, *Trace elements, Sediments, Chemical properties, Water chemistry, Sampling, Data collections, Statistical methods, Regression analysis.
Identifiers: *Marine mud-fresh mud differences.

A wide sampling of 82 modern marine and freshwater muds was analyzed for B, Cr, Ga, Ni, V, clay, clay minerals, calcium carbonate, and organic carbon. Results show that total B is highly correlated with the amount of clay; for a given clay content, modern marine muds contain about 30-45 ppm more B than modern freshwater muds. Illite has little if any control on B concentration in muds. A discriminant function based on B and clay was found to be the most practical and effective combination for distinguishing between modern marine and freshwater environments. If a single differentiator is used, B is superior to clay content. The elements Cr, Ga, Ni, and V are not collectively good differentiators; clay minerals, calcium carbonate and organic carbon also fail to distinguish the 2 environments effectively. Data support the theory of Levinson and Ludwick (1966) that B in modern marine muds increases progressively seaward from a strandline as the amount of total clay increases. (Knapp-USGS)
W70-00994

FORMATION OF HYDROXY-AL AND -FE INTERLAYERS IN MONTMORILLONITE AND VERMICULITE: INFLUENCE OF PARTICLE SIZE AND TEMPERATURE,
Geological Survey, Washington, D.C.
D. D. Carstea.
Clays and Clay Minerals, Vol 16, p 231-238, 1968. 8 p, 3 tab, 30 ref.

Descriptors: *Clay minerals, *Aluminum, *Iron, *Montmorillonite, Particle size, Temperature, X-ray diffraction, Analytical techniques, Cation exchange, Spectrophotometry, Acidity, Moisture uptake, Mineralogy.
Identifiers: *Hydroxy-interlayer formation, Vermiculite.

This paper describes the influence of temperature and particle size upon the formation of synthetic hydroxy-Al and -Fe interlayers and shows applications to natural conditions in expanding clays. Hydroxy-Al and -Fe interlayers were prepared in 'mono-mineralic' fine and coarse clay montmorillonite and coarse clay and silt vermiculite at 3 deg C and 21 deg C. At comparable particle size and regardless of temperature, the amounts of hydroxy-Al and -Fe interlayers in montmorillonite exceeded by far those formed in vermiculite. Likewise, the aluminum systems exhibited a higher degree of interlayering than iron systems. Within montmorillonite, the amount of hydroxy-Al and -Fe interlayers increased as the particle size decreased, regardless of temperature. Within vermiculite systems equilibrated at 3 deg C, more hydroxy-Al interlayers were recorded in coarse clay than in silt fraction, whereas at 21 deg C about equal amounts of interlayers were formed. By contrast, hydroxy-Fe interlayer was favored by the silt fraction at both temperature levels. The formation of aluminum interlayers in both minerals increased with increasing temperature. The formation of hydroxy-Fe interlayers in montmorillonite was generally not temperature dependent, whereas the formation of such interlayers in vermiculite increased slightly with increasing temperature.
W70-01014

ON THE DIFFUSION PHENOMENA IN BOUNDARY LAYERS OF TURBULENT FLOW AND ITS INFLUENCE ON THE COURSE OF THE SELF-PURIFICATION OF SMALL STREAMS,
For primary bibliographic entry see Field 05C.
W70-01037

CALCIUM CARBONATE INTERACTION WITH ORGANIC COMPOUNDS,
Lehigh Univ., Bethlehem, Pa. Marine Science Center.
Erwin Suess.
Available from the Clearinghouse for Sci and Tech Inf as AD-676 524 at $3.00 in paper copy or $0.65 in microfiche. A dissertation presented to the Grad Fac of Lehigh Univ in candidacy for Degree of Doctor of Phil in Geol Sci 1968. 153 p, 31 fig, 18 tab, 132 ref.

Descriptors: *Calcium carbonate, *Organic compounds, Carbonate rocks, Carbonates, Limestones, Seawater, Aqueous solutions, Aggregates, Environment, Phosphorus, Calcite, Diagenesis, Mineralogy, Adsorption, Organic matter, Deep water, Sediments, Connate water, Equilibrium, Dolomite, Hydrogen ion concentration, Free energy, Boundaries (Surfaces).
Identifiers: *Chemical processes, Albumin, Stearic acid, Aragonite, Concentration effects, Temporal effects, Monolayers, Half-layers, Surface-free energy, Calcite, Seawater ratios, Surface effects.

Dissolved organic compounds interact with surfaces of calcium carbonate minerals effecting equilibration between solution and solid. Demonstrable associations are: stearic acid and calcite and dolomite; albumin with aragonite, calcite, and magnesium-calcite. Carbonate minerals in hexane adsorb stearic acid with monolayer formation on calcite surfaces and half-layers on dolomite surfaces. Interaction is restricted to calcium sites of

solids and carboxyl acid groups. In aqueous solution, stearic acid adsorbed on carbonate mineral surfaces is insufficient to form a monolayer. Hydrated surface complexes are sufficient to cover surfaces of these minerals. Low aqueous concentrations of albumin form monolayers on carbonate minerals; greater concentrations, increasing time and pH, multilayers or non-oriented aggregates form on calcite and aragonite surfaces. Organo-carbonate associations affect calcium carbonate equilibrium by physically isolating mineral surfaces, and by reducing surface-free energy of solids. Organic compounds containing phosphorus influence calcite-seawater interaction. At low calcite to seawater ratios (C/SR) adsorbed surface-active organic matter (stainable with methylene blue) is visible on calcite surfaces. At high C/SR, seawater is depleted of surface-active organic matter, equilibrating inorganically with carbonate minerals. Surface seawater, deep water, and interstitial water equilibrate inorganically at different C/SR, which are constant for each sample, whether equilibrium is approached from under- or oversaturation. (Simsiman-Wisconsin)
W70-01069

PERSISTENCE OF DIAZINON AND ZINOPHOS IN SOIL: EFFECTS OF AUTOCLAVING, TEMPERATURE, MOISTURE, AND ACIDITY,
Western Washington Research and Extension Center, Puyallup.
L. W. Getzin.
Journal of Economic Entomology, Vol 61, No 6, p 1560-1565, Dec 1968. 8 fig, 3 tab, 11 ref.

Descriptors: *Diazinon, *Soils, *Insecticides, Persistence, Temperature, Moisture, Acidity, Microorganisms, Hydrogen ion concentration, Water pollution effects, Water pollution sources, Degradation (Decomposition), Biodegradation, Organophosphorus pesticides, Gas chromatography.
Identifiers: *Zinophos, *Autoclaving effects, *Thermal effects, *Moisture effects, *Chemical processes, Sultan silt loam, Acidophilic organisms, Basiphilic organisms.

Effects were studied of autoclaving, temperature, moisture, and pH on diazinon and Zinophos persistence in a Sultan silt loam. Nonbiological degradation mechanisms were primarily responsible for breakdown of diazinon. Half-life of diazinon was 5 weeks in nonautoclaved soil and 6 weeks in autoclaved soil. Zinophos was degrated to a greater extent by microorganisms than diazinon. Half-life of Zinophos in the autoclaved and nonautoclaved soil was 9 and 2 weeks, respectively. Higher temperatures and soil moisture levels accelerated decomposition of both insecticides. The persistence of both insecticides was also influenced by soil pH but through different mechanisms. Nonbiological degradation of diazinon was shown to increase with increasing acidity, while pH had no effect on non-biological decomposition of Zinophos. However, biological decomposition of Zinophos was minimal at pH 5.5, increasing at higher and lower pH values; these data suggest that basiphilic and acidophilic organisms possess the capacity to degrade Zinophos. Attempts to show that soil accelerates the nonbiological decomposition of these insecticides were unsuccessful. (Graetz-Wisconsin)
W70-01079

A GROUNDWATER QUALITY SUMMARY FOR ALASKA,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 04B.
W70-01087

DYNAMICS OF PHYSICOCHEMISTRY IN A LARGE RESERVOIR,
Alabama Agricultural Experiment Station, Auburn.
J. M. Lawrence.
IN Reservoir Fishery Resources Symposium, Apr 5-7, 1967, Athens, Georgia, p 100-113, Nov 1968. 6 fig.

Descriptors: *Water chemistry, *Physicochemical properties, *Reservoirs, Currents (Water), Stratification, Thermocline, Oxygen, Circulation, Magnesium, Calcium, Water pollution, Density currents, Limnology, Dye releases, Water pollution sources, Hardness (Water), Iron, Carbon, Alabama, Georgia.
Identifiers: Walter F George Reservoir (Ala-Ga), Lake Eufaula (Ala-Ga).

Data are presented on stratification, density currents, dissolved oxygen content, total hardness, total iron concentration, and total carbon in Walter F George Reservoir (Lake Eufaula) during 1965 and 1966. Thermal and chemical stratification occurred during summer months, although partial or complete mixing occurred at least four times during both years after periods of cool, rainy weather. Retarded bottom currents, due to low-stream flow, facilitated stratification, and density currents existed in some regions when stratification prevailed. Use of fluorescent dye indicated that a causeway-type bridge caused upstream flowing currents. Total hardness was relatively low; the concentration of magnesium was fairly constant, while calcium concentration varied considerably among sampling sites. Concentration of total iron appeared to be associated with suspended particles. Concentrations of total carbon was high in one area due to organic pollution in 1965, but the source was largely eliminated by 1966. (Byrnes-Wisconsin)

2L. Estuaries

ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION, 1963-65, UNITED STATES AND CANADA.
Engineering-Science, Inc., Los Altos, Calif.
For primary bibliographic entry see Field 02J.
W70-00837

PHYSICAL MODELING OF REGIME OF BODIES OF WATER TO STUDY THEIR SANITATION CONDITION (IN RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 05B.
W70-00885

MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
General Electric Co., Philadelphia; and Federal Water Pollution Control Administration, Philadelphia, Pa.
For primary bibliographic entry see Field 05C.
W70-00896

DISTINGUISHING MARINE AND FRESHWATER MUDS,
Illinois Geological Survey, Urbana; and Indiana Univ., Bloomington.
For primary bibliographic entry see Field 02K.
W70-00994

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

ANALYSIS AND OPTIMIZATION OF A REVERSE OSMOSIS PURIFICATION SYSTEM--PART II. OPTIMIZATION,
Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
L. T. Fan, C. Y. Cheng, L. Y. S. Ho, C. L. Hwang, and L. E. Erickson.
Desalination, Vol 6, No 2, p 131-152, June 1969. 5 fig, 9 tab, 8 ref.

Descriptors: *Water purification, *Optimization, *Reverse osmosis, *Mathematical models, *Recirculated water, *Operating costs, Membrane processes, Design, Capital costs, Flow characteristics, Brines, Water supply.
Identifiers: Multistage operation, Flow-work exchanger.

A mathematical model of a reverse osmosis water purification system that could be used in process optimization studies had been developed in Part I of this study. In this part, the model was used to determine design and operating variables of the system, which minimized the cost of water production. Several three multistage reverse osmosis systems were considered. They were (1) a multistage operation without the use of a flow-work exchanger and with a variable membrane area at each stage, (2) a multistage operation without the use of a flow-work exchanger and with equal membrane at each stage, and (3) a multistage operation with the use of a flow-work exchanger and with variable membrane area at each stage. In the optimization study, the recirculation rate in each stage, the brine composition leaving each stage, the ratio of membrane area to feed at each stage, and the operating pressure in each stage were controlled to arrive at a minimum water production cost. The study showed that the method presented could be used to accomplish optimum designs of complex processes requiring the simultaneous optimization of several variables. (Thiuri-Cornell)
W70-00890

EXPERIMENTAL STUDY OF SLURRY SEPARATORS FOR USE IN DESALINATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
Joseph Shwartz, and Ronald Probstein.
Desalination, Vol 6, No 2, p 239-266, June 1969. 15 fig, 1 tab, 6 ref.

Descriptors: *Slurries, *Mathematical models, *Desalination processes, Optimization, Brines, Ice, Salt balance, Fresh water, Feasibility, Productivity.
Identifiers: Freeze-distillation process, Counterwashers.

A mathematical model was developed and used to investigate the characteristics and performance of laboratory scale counterwasher slurry separators. The separators were of a type related to those used for the separation of brine from ice crystals in the freeze-distillation process. Polyethylene particles were used in the experiments to simulate the ice crystals. One of the main purposes of the experiments was to check out a model and the theory of such counterwashers previously developed by the authors. The experiments demonstrated the validity of the theoretical conclusions and helped to establish the optimal operating conditions for high production rates, sufficiently low salt content in the product and minimum loss of fresh water. The feasibility of obtaining high rates of crystal washing was demonstrated. The highest steady production rate obtained in the experiments was equivalent to 8000 lbs/hr ft of brine-free ice in the freeze-distillation process. This rate, however, was shown to be well below the maximum obtainable. (Thiuri-Cornell)
W70-00892

THE OPTIMUM TEMPERATURE FOR THE OPERATION OF A NON-SCALING MULTI-STAGE FLASH EVAPORATOR PLANT,
California Univ., Richmond. Sea Water Conversion Lab.
Lester H. MacLeod, Abraham Gendel, and Ahmed F. ElSahrigi.
Sea Water Conversion Lab Rep No 63-1, Jan 1963. 42 p, 10 fig, 20 ref.

Descriptors: *Flash distillation, *Optimization, *Temperature control, *Sea water, *Mathematical models, Systems analysis, Economics, Thermodynamic behavior, Scaling, Fresh water.

A multi-stage flash distillation plant offered one of the most economical means of converting sea water to fresh water and was therefore, chosen as the subject of an optimization study. Mathematical equations were established which allowed the determination of the cost of heat, pumping power and heat exchanger surface per unit of product. Evaluation of these equations, in the absence of experimental sea water data beyond 212 deg F, required some extrapolation of sea water properties, using well established thermodynamic relationships. Based on this data, and the assumption of a non-scaling system, it was concluded that the optimum temperature of the feed stream leaving the heater lies between 350 deg and 400 deg F, and that, by operating with this optimum temperature, it was possible to reduce the cost per thousand gallons of product by $0.10 to $0.15 below the cost for a plant with corresponding temperature of 210 deg F. (Thiuri-Cornell)
W70-00907

3B. Water Yield Improvement

OPTIMIZATION OF THE LONG-TERM OPERATION OF A SINGLE-PURPOSE RESERVOIR,
Belgrade Univ. (Yugoslavia).
Slavoljub Jovanovic.
Proc, Int Hydrol Symp, Vol 1, Colo State Univ, p 422-429, Sept 1967. 8 p, 3 fig, 6 ref.

Descriptors: *Optimization, *Reservoir operation, *Markov processes, *Linear programming, *Long-term planning, Optimum development plans, Dams, Storage capacity, Hydroelectric plant.
Identifiers: Single-purpose reservoir, Howard's algorithm.

The analysis of an optimum operating policy for a single-purpose reservoir was presented. It was assumed that water could be released from the dam through different alternatives (decisions) and that sequential decisions formed an operating policy. Linear programming and Markov chain techniques were used for selecting the policy which maximized the average release of water from the dam in long term operation. Howard's algorithm made it possible to find the optimum policy by means of relatively low number of iterations. The model was applied to a storage hydroelectric plant as an example. (Thiuri-Cornell)
W70-00901

A WATER YIELD MODEL DERIVED FROM MONTHLY RUNOFF DATA,
Office of Tributary Area Development, Knoxville, Tenn.
Willard M. Snyder.
World Meteorol Organ Int Ass Sci Hydrol Symp, Berkeley, p 18-30, Aug 1963. 13 p, 2 fig, 3 tab, 4 ref.

Descriptors: *Water yield, *Mathematical models, *Streamflow, *Watershed management, *Rainfall-runoff relationships, Least squares method, Numerical analysis, Optimization, Evaporation pans, Seasonal.

A mathematical model was developed to analyze past records of streamflow and to predict dependable yield for watersheds under varying patterns of rainfall. The model contained three parts: (1) a seasonal rainfall function that generated potential runoff in tow phases; immediate and delayed, (2) a distribution function that delivered the delayed runoff to future streamflow, and (3) a time-trend function that compensated for changing watershed conditions. Ten test sets of data were analyzed. The model was fitted to the data by composite techniques of non-linear least squares and component analysis. This method of numerical analysis produced consistent results. Seasonal losses corresponded closely in both magnitude and phasing to expected values based on pan evaporation. The time-trend function did not produce satisfactory results. The yield study was an effort to produce another tool or measuring technique that was necessary for optimum and unified development. (Thiuri-Cornell)
W70-00905

A HYDROGEOPHYSICAL SURVEY FROM KAWAIHAE TO KAILUA-KONA, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
William M. Adams, Frank L. Peterson, Surendra P. Mathur, Larry K. Lepley, and Clifton Warren.
Available from the Clearinghouse as PB-187 520, $3.00 in paper copy, $0.65 in microfiche. Hawaii Water Resources Research Center, Technical Report No 32. Sept 1969. 156 p. OWRR Proj B-011-HI.

Descriptors: Hydrogeophysical, Aeromagnetic, Infrared, Audiomagnetotellurics, Electrical resistivity, Thermal anomalies, Brackish water, Basal groundwater, Resistivity profiling, Hawaii, Kawaihae, Kailua-Kona, Reconnaissance, Development.

Several geophysical surveys have been conducted over the coastline area between Kawaihae and Kailua-Kona for the purpose of locating the optimum sites for possible development of groundwater from the basal lens. A low-level aeromagnetic survey over the area and an infrared scanning effort along the coast with surface verification provided general reconnaissance information. Audiomagnetotelluric and D. C. electrical resistivity profiles defined more detailed, local structures. The infrared scanning survey along the coastline did not reveal any thermal anomalies that are reasonably attributable to previously unknown outflows of brackish water of magnitudes adequate for currently anticipated commercial exploitation. However, the aeromagnetic and audiomagnetotelluric surveys locate four lines which are possible barriers to lateral movement of basal ground water. The D. C. electrical resistivity profiling was conducted at an elevation of about 100 feet or less. Based on the resistivity data, three possible sites are selected -- two are in the north near Puako Bay and the other is above the present Kona Airport.
W70-00908

VILLAGE WATER SUPPLY INVESTIGATION, TERRITORY OF PAPUA AND NEW GUINEA,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
J. P. MacGregor, and J. R. L. Read.
Eng Geol, Vol 3, No 3, p 217-232, July 1969. 16 p, 5 fig, 3 ref.

Descriptors: *Water supply, *Municipal water, *Domestic water, *Water resources development, Water wells, Aquifers, Water quality control, Canals, Wellpoints, Water yield.
Identifiers: *New Guinea.

The Territory of Papua and New Guinea has water supply problems despite its relatively high rainfall. The population lives mostly in villages and obtains its drinking water from streams and wells that are subject to pollution and drought. A Village Water Supply Survey Team was set up to review the present position district and make recommendations for the development of water supplies. Any village water supply scheme recommended must be cheap to install and maintain and should provide an adequate supply of fresh water which cannot readily be polluted. Deep drilling is too expensive to provide a solution at this stage of development. It has been found that supplies of fresh water can be obtained in, or near, most villages and settlements by sinking a protected large diameter well or by tapping a sandy aquifer. Water from surface streams can be gravitated to a village in appropriate situations provided bacterial contamination can be avoided. Where suitable groundwater cannot be located an artificial rainwater catchment and storage is generally the best alternative. (Knapp-USGS)
W70-00991

OPTIMIZATION TECHNIQUES IN WEATHER MODIFICATION,
Denver, Colo.
P. J. Stinson.
Proc Ser No 5, Proc Nat Symp Analysis Water-Resour Syst, p 79-94, July 1968. 16 p, 8 fig, 11 ref.

Descriptors: *Weather modification, *Optimization, Water requirements, Water resources, Dry ice, Technology, Precipitation (Atmospheric), Legal aspects, Meteorology, Mathematical models, Simulation, Systems analysis, Social aspects, Economics, Mathematics, Cloud seeding, Silver iodide, Weather data, Nucleation, *Operations research, Atmospheric physics.
Identifiers: Cloud modification, *Atmospheric research, Ice crystals, Nuclei generators, Systems engineering.

Precipitation management research programs offer a complex system including scientific and engineering developments and much human ingenuity. Maximum effectiveness can be achieved best through the optimization of a sequence of processes and their interactions including: (1) cloud systems, (2) cloud treatment systems, (3) experimental design and statistical evaluation of precipitation data, (4) computer simulation and mathematical modeling, and (5) the total system. Each optimization process in the sequence produces a beneficial result and in combination with other processes in the sequence produces the most effective enhancement of water supply. The ultimate system involves a scientific, interdisciplinary approach including systems engineering, systems analysis, and other operations research techniques. (USBR)
W70-01122

THE LAND AND WATER USE SURVEY OF NORTH-CENTRAL KORDOFAN (1961-66),
London Univ. (England). School of Oriental and African Studies.
J. H. G. Lebon.
Geographical Journal, Vol 134, No 4, Dec 1968, p 546-550. p 5, 14 ref.

Descriptors: *Arid lands, *Grazing, *Surveys, Social impact, Maps, Grasslands.
Identifiers: *Sudan, *Kordofan, *Catchments, Africa.

The article reviews a series of F.A.O. reports on land and water use in Kordofan Province, Republic of Sudan. Kordofan is located in the drier savanna zone of Africa which has a severely limited perennial water supply. The area is economically retarded, with both grazing and the limited agriculture tending to concentrate in the few areas where water is available perennially. Hence, pasture and soils are deteriorating. Work is underway to develop catchment and cistern systems for the drier northern area where no subsurface water is available. Some of the area does support the well adapted Acacia senegal and research is underway to improve output of gum arabic. The reports present general maps of resources of the area and review practices of the largely pastoral and nomadic tribes that inhabit it. These may serve as bases for future resource and social research and development. (Crouse-Arizona)
W70-01198

WATER SUPPLIES IN SOUTH AUSTRALIA,
Hull Univ. (England). Dept. of Geography.
Peter Crabb.
Geography, Vol 53, No 3, 1968, p 282-293. 12 p, 4 fig, 6 tab, 16 ref.

Descriptors: *Arid lands, *Irrigation, *Water resources development, *Water transfer, *Reservoirs, Water supply, Consumptive use, Municipal water, Rivers, Desalination.
Identifiers: *Australia, *South Australia, River Murray.

Four-fifths of South Australia has an average precipitation of less than 10 inches. A long term

development program, reviewed in this paper, has made essentially unrestricted water use available to most of the state's population of over one million. An intricate system of diversions, reservoirs, interbasin transfers and groundwater pumping started in the mid-19th century has supported continuous population and economic growth of the Adelaide metropolitan area. Problems of water supply for rural parts of the state, distant from the Adelaide Hills, are somewhat more difficult; every possible stream, intermittent or otherwise, has been exploited, including long transfers from the River Murray lying to the east. A solar distillation plant converts saline groundwater for one mining community. New storage and diversion projects along the Murray will support some additional development, but beyond that desalination of sea water will be necessary. (Crouse-Arizona)
W70-01204

THE WATER PROBLEM IN THE DESERTS OF THE USSR,
All-Union Research Institute for Water Engineering and Reclamation, Moscow.
L. V. Dunin-Barkovskiy.
Trans from Problemy Osvoyeniya Pustyn, No 1, 1967, p 13-22. Soviet Geography: Review of Translation, Vol 9, No 6, 1968, p 458-468. 11 p, 7 ref.

Descriptors: *Arid lands, *Irrigation programs, *Salinity, *Water improvement, *Deserts, Weather modification, Drainage systems, Phreatophytes, Evaporation control, Saturated soils, Desalination.
Identifiers: *USSR.

The author reviews existing and planned irrigation projects in arid and semiarid regions of the USSR. There is great potential for irrigation based on water from rivers transversing the vast arid region. To the west, waters of rivers such as the Volga, used largely for power generation and transportation until now, are expected to support large irrigation projects in the future. The Eastern and north eastern deserts have limited flow available for irrigation projects. Such development would require diversion of water from distant Siberian streams. In some cases desalination of present surface and groundwaters or weather modification might be reasonable alternatives. Central Asia and Kazakhstan which have 2/3 of the present irrigated land in the U.S.S.R., offer great potential with better regulation of melt water flows from the major mountain ranges. Control of phreatophytes and of evaporation from surface waters offer a real potential for improving stream flow. Water logging and salinity problems in currently irrigated areas indicate need for better drainage planning in future projects. (Crouse-Arizona)
W70-01215

THE STUDY OF LOCAL WATERS IN THE DESERTS OF THE USSR,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
V. N. Kunin.
Trans from Problemy Osvoyeniya Pustyn, No 5, 1967, p 40-56. Soviet Geography: Review and Translation, Vol 9, No 6, 1968, p 469-488. 20 p, 67 ref.

Descriptors: *Arid lands, *Underground storage, *Recharge, *Perched water, *Deserts, Grazing, Impervious soils, Confined water, Groundwater basins, Surface waters, Runoff, Hydrogeology, Fresh water, Water resources development.
Identifiers: *USSR, *Catchments, Takyrs.

The author presents a broad review of current knowledge and of the potential of fresh water sources in desert regions of the U.S.S.R. These could be used for watering livestock herds, herder's settlements, and suitable industrial enterprises. Intensive agricultural use in large irrigation projects, except to meet limited local needs, is generally discouraged. There is insufficient recharge in most areas to maintain such projects over the long run. One of the most promising approaches, both economically and technically, is the use of clay plans as catchments for recharge of natural aquifers or artificial storage tanks. Large areas are found to have fresh water lenses perched on deeper saline ground water. With proper development so as to prevent salt water intrusion, these could prove useful and more economical for watering livestock than deep wells requiring long lifts. Artesian sources located far from recharge areas have generally been saline. (Crouse-Arizona)
W70-01216

3C. Use of Water of Impaired Quality

WATER QUALITY AND REGIONAL ECONOMY, A DECISION MODEL,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 05G.
W70-00897

OASES FOR THE FUTURE,
Rochester Inst. of Tech., N.Y.
For primary bibliographic entry see Field 06B.
W70-01203

EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS: SIGNIFICANCE OF EXTERNAL WATER-POTENTIAL AND SALT-TRANSPORT KINETICS ON RATE OF CELL EXPANSION,
California Univ., Riverside.
For primary bibliographic entry see Field 02I.
W70-01214

3D. Conservation in Domestic and Municipal Use

HAS RECENT LEGISLATION LIMITED PRIVATE RIPARIAN RIGHTS IN IOWA,
Keith McKinley.
Drake L Rev, Vol 8, No 1, p 59-65, Dec 1958. 7 p, 52 ref.

Descriptors: *Iowa, *Riparian rights, *Preferences (Water rights), *Water allocation (Policy), Legislation, State governments, Water rights, Artificial use, Irrigation water, Legal aspects, Natural use, Relative rights, Water law, Water utilization, Competing uses, Regulated flow, Consumptive use, Water management (Applied), Water permits, Water policy, Water supply, Withdrawal, Water demand, Water resources, Regulation, Priorities, Average flow.

Recent Iowa legislation regulating the consumptive use of water resources has not substantially changed the common law rights of private riparian owners as developed by the Iowa Supreme Court. While creating a new right in non-riparian users, the rights of riparian owners have not been limited. Riparian owners still have unlimited use of water resources for ordinary and natural uses, termed non-regulated uses by the legislature. Artificial, or regulated, use is still limited to the extent that there is to be no interference with natural uses by other riparians. Although any person may apply for a permit to withdraw water, the rights of non-riparians are clearly inferior to the rights of private riparian owners. As between two non-riparian applicants, the first in time is given priority. The new legislation preserves the common law rights of riparians, yet it provides for maximum utilization of water resources by making water available to non-riparian users for the first time. (Douberley-Florida)
W70-01133

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01187

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01188

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01189

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01190

WATER POWER AND RESOURCES.
For primary bibliographic entry see Field 06B.
W70-01192

3E. Conservation in Industry

FISH, OYSTERS, SHELLFISH, AND OTHER MARINE LIFE: MARINE RESOURCES COMMISSION AND COMMISSIONER OF MARINE RESOURCES.
Va Code Ann secs 28.1-1 thru 28.1-22 (1969).

Descriptors: *Virginia, *Fish, *Oysters, *Commercial fishing, Administrative agencies, Administration, Commercial shellfish, Commercial fish, Taxes, Fish conservation, Fish management, Permits, Inspections, Surveys, Legal aspects, Legislation, Tidal waters, Regulation.
Identifiers: Seafood industry, Oyster repletion.

The counties which make up 'tidewater Virginia' are enumerated herein. The Commission of Fisheries is renamed the Marine Resources Commission. The chairman is to be appointed by the governor and must have knowledge of seafood and marine affairs. The Commissioner is responsible for enforcement of the fish and shellfish laws and those laws related to the fish and shellfish industries in the tidewaters of the state. The Commissioner, with Commission approval, may purchase or rent such equipment as may be required to perform his duties. The Commissioner is obligated to investigate all matters affecting the seafood industry and to make reports on revenues derived from the shellfish industries, the condition of those industries, and possible legislation aimed at betterment or protection of them. No employee or official of the Commission may be granted a license to engage in commercial fishing in Virginia. The Commission shall appoint civil engineers to make surveys of all oyster-planting grounds and of natural oyster beds or shoals as necessary. The Commission shall also appoint a conservation and repletion officer to head the oyster and shellfish repletion program. (Kelly-Florida)
W70-01161

MARINE RESOURCES COMMISSION.

Va Code Ann secs 28.1-23 thru 28.1-36 (1969).

Descriptors: *Virginia, *Marine fisheries, *Fish conservation, *Administrative agencies, Legislation, Legal aspects, Regulation, Permits, Public health, Natural resources, Shellfish, Fishing, Commercial fishing, Supervisory control (Power).
Identifiers: *Marine resources, *Seafood industry, Penalties (Criminal).

The Marine Resource Commission is authorized to make such regulations as it deems necessary to promote the general welfare of the seafood industry and to conserve and promote the seafood and marine resources of the state. The Commission may regulate the taking of seafood so long as such regulations do not conflict with the provisions of statutory law. The Commission is empowered to establish licenses for the use of devices used to take seafood commercially. Violation of Commission

regulations is punishable by criminal penalties. Regulations must be published in a specified manner before promulgation in order that public hearings can be held, except emergency regulations of limited duration may be adopted without publication where necessary for the immediate preservation of the public peace, health, safety, welfare, protection of the seafood industry, or natural resources or marine animals. The procedure at hearings on proposed Commission regulations is provided for. Judicial review of Commission decisions at the hearings and of the regulations themselves is established. (Keith-Florida)
W70-01162

SURVEYS OF AND RIGHTS IN OYSTER GROUNDS.

Va Code Ann secs 28.1-100 thru 28.1-107 (1969).

Descriptors: *Virginia, *Oysters, *Administrative agencies, *Surveys, Maps, Mapping, Shellfish, Commercial shellfish, Commercial fishing, Beds under water, Conservation, Shoals, Bays, Legislation, Regulation, Jurisdiction, Local governments, Legal aspects.
Identifiers: Oyster beds.

The Baylor Survey, which is the official survey of oyster grounds in this state, may be changed or resurveyed by the Commission of Fisheries. Copies of Commission maps showing oyster grounds must be filed with the clerk of the county or city having jurisdiction over the respective underwater areas. If a surveying mistake places part of an oyster-planting ground in a natural oyster bed, the leaseholder of the planting grounds may remove his oysters upon obtaining Commission approval. Oyster grounds should be designated by prominent markers. It is unlawful to remove any oyster-ground markers or for any person other than the leaseholder to remove oysters from an oyster ground. (McDonough-Florida)
W70-01163

LEASING OYSTER-PLANTING GROUNDS.

Va Code Ann secs 28.1-108, 28.1-109 (1969).

Descriptors: *Virginia, *Riparian rights, *Oysters, *Commercial shellfish, Commercial fishing, Administrative agencies, Surveys, Bays, Bodies of water, Legislation, Leases, Fisheries, Fish management, Rivers, Legal aspects, Water law.
Identifiers: Oyster beds.

Riparian owners owning land bordering on oyster-planting areas may apply for oyster grounds in front of their land. The leasing of oyster grounds is recorded, and the leasehold of a riparian owner passes with the sale or transfer of the riparian land. State residents, firms, and domestic corporations in the oyster business may lease oyster grounds from the Commission of Fisheries. Applications for leases should state the location and number of acres of the oyster ground desired. Except in the Chesapeake Bay, no single assignment of oyster grounds may exceed two hundred fifty acres, and no combined allotment to any person, firm, or corporation may exceed three thousand acres. Leases are for twenty years and may be renewed. Leaseholders' rights to oyster grounds are subject to riparian rights and fishing rights. (McDonough-Florida)
W70-01164

TRANSFER OF OYSTER-PLANTING LEASES; RIGHTS OF RIPARIANS.

Va Code Ann secs 28.1-110 thru 28.1-118.1 (1969).

Descriptors: *Virginia, *Oysters, *Commercial shellfish, *Riparian rights, Leases, Administrative agencies, Local governments, Navigation, Highways, Legislation, Legal aspects, Oysters, Eminent domain, Conservation, Fisheries, Fish management, Water law, Beaches, Ownership of beds, Beds.
Identifiers: Oyster-planting grounds.

No person may use natural oyster grounds or bottoms not assigned to him. Lease-holders of oyster-planting grounds may transfer or assign their leases to state residents and domestic corporations in the oyster business. A transfer creates a new twenty-year lease and includes the balance of time remaining under the assigned lease. The Commission of Fisheries may decide not to collect rents for oyster grounds in disaster areas for oyster culture. The state highway and conservation departments and municipalities have eminent domain rights to any oyster bottoms within their respective jurisdictions. Riparian owners owning land surrounding creeks, coves, or inlets less than one hundred yards wide have exclusive shellfish-planting rights to the bottom. Leaseholders may erect oyster watchhouses that do not obstruct navigation. Leases to oyster grounds are subject to the rights of riparian owners wishing to build bulkheads or wharves in front of their land. Any person may apply to the Commission for a permit to establish a bathing beach. (McDonough-Florida)
W70-01165

CULLING OYSTERS.

Va Code secs 28.1-124 thru 28.1-127 (1969).

Descriptors: *Virginia, *Oysters, *Commercial shellfish, *Administrative agencies, Legislation, Commercial fishing, Conservation, Fish management, Legal aspects, Size, Public rights, Shellfish, Regulation, Control.

Oysters taken from public, natural oyster beds must be culled at the place of taking. Shells under the statutory length must be replaced. It is unlawful to buy, sell, or possess oysters under the prescribed size. Catchers violating oyster size requirements may be required to scatter their entire cargo onto the public oyster rocks or post a cash bond. Throwing oysters or shells overboard (other than in the ordinary process of culling) upon the approach of an oyster inspector is evidence of violation of this chapter. (McDonough-Florida)
W70-01166

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01187

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01188

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01189

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01190

WATER POWER AND RESOURCES.
For primary bibliographic entry see Field 06B.
W70-01192

WATER RESOURCES AND THE CHEMICAL INDUSTRY IN NEW JERSEY: AN ECONOMETRIC AND ENGINEERING ANALYSIS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 06D.
W70-01217

3F. Conservation in Agriculture

EFFECTS OF CULTIVATION AND GRASS ON SURFACE RUNOFF,
Agricultural Research Service, Coshocton, Ohio. Corn Belt Branch.
For primary bibliographic entry see Field 04A.
W70-00863

SIMULATION OF RUNOFF FOR DESIGN OF WATER RESOURCE SYSTEMS,
State Water Plan Development of Water Resources Management, Prague (Czechoslovakia).
For primary bibliographic entry see Field 04A.
W70-00900

PAT HARRISON WATERWAY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00958

PAT HARRISON WATERWAY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00959

PAT HARRISON WATERWAY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00960

A PHYSICAL AND ECONOMIC ANALYSIS OF ALTERNATIVE IRRIGATION METHODS IN A SUB-HUMID CLIMATE,
North Dakota State Univ., Fargo.
E. C. Stegman, G. A. Johnsgard, A. Bauer, and D. O. Anderson.
Available from the Clearinghouse as PB-187 684, for $3.00 in paper copy, $0.65 in microfiche. Research Project Technical Completion Report, Sept, 1969. 60 p, 16 tab, 12 fig, 72 ref. OWRR Proj B-007-NDAK.

Descriptors: *Irrigation system design, *Alternative irrigation methods, Irrigation program simulation, Crop production functions, Irrigation economic analysis, Irrigation.

The question of on-farm system investment levels which are needed to produce near optimum returns is a difficult and relevant design problem for irrigation system planners. This question is particularly relevant to many humid and sub-humid areas where crops can be profitably produced without irrigation. The methodology of this project has centered upon the development of computational models which simulate in detail the operation of specific types of sprinkler irrigation systems. These models are being applied to the long term climatic record of a test area (Oakes Irrigation District of North Dakota) to compute probability distributions of parameters (i.e. number of irrigations, days of system operation, acre inches of water pumped, crop yield potential, etc.) which may be utilized to evaluate the physical and economic potential associated with specific system types, capacities, and imposed management regimes. The computational models are being applied to combinations of physical parameters (soils, crops, and irrigated unit size) which are expected to be representative of the test area during early stages of irrigation development. Relevant cost and return functions may then be applied for economic analysis either as a second phase to this project or at such time a planner is in need of such analysis. This report describes the development of the computational models and associated analyses relative to the test area and the selection of model inputs. These analyses include: (1) The identification and selection of physical conditions representative of the Oakes Irrigation District; (2) The development of crop production functions; (3) The development of computer simulation models for specific sprinkler system types; (4) Example model applications.
W70-01086

NEW WATER BIRD FOR EGYPT: A ROBOT SHADOOF,
Rand Corp., Santa Monica, Calif.
Richard Murrow.
Ekistics, Vol 24, No 142, p 256-260, 1968. 5 p, 2 fig.

Descriptors: *Arid climates, *Irrigation operation and maintenance, *Water conveyance, *Farm equipment, Irrigation efficiency.
Identifiers: *Egypt, *Shadoof.

The shadoof is an ancient and simple man-operated fulcrum device which lifts water from an irrigation canal into the irrigated field. It is the most preferred irrigation device in Egypt but is enormously wasteful of man power. The common toy 'drinking bird' alternately bobs forward into drinking position, then returns to erect standing position in an endless cycle. This engine requires virtually no service or attendance and involves little frictional wear to create demands for lubrication or replacement. High Nile Valley temperatures offset by drying winds should keep a 'bird' going virtually indefinately. The author added a tube with a scoop near the head which would scoop up water as from a canal and carry it backward through the tube to be dumped into another container at a higher level, such as the Egyptian field. A laboratory model seven feet in length using Freon 11 as the internal working fluid has performed successfully. Using proper materials such an engine could be built for a cost of $50 to $100, be portable, and perform efficiently the work of a man scooping up water each day. (Crouse-Arizona)
W70-01205

ESTIMATION OF GRAZING CAPACITY ON ARID GRAZING LANDS,
Soil Conservation Service, New South Wales.
R. W. Condon.
IN G. A. Stewart, Ed., Land Evaluation, Papers of a CSIRO Symposium Organized in Cooperation with UNESCO, Macmillan of Australia, p 112-124, Aug 26-31, 1968. 13 p, 4 fig, 7 ref.

Descriptors: *Arid lands, *Grazing, *Land classification, *Rainfall, *Pasture management, Soil types, Topography, Soil-water-plant relationships, Carrying capacity, Range management, Stocking, Estimating.
Identifiers: *Australia, *New South Wales, Vegetation density.

The author describes a method developed for estimating safe grazing capacity for arid lands in Australia. Rating scales were established for factors influencing grazing capacity. Those factors increasing capacity were given a plus rating; those with an adverse effect, a penalty rating. It was necessary to establish the capacity for a base or standard land class and rating scales for the factors that would influence variance from the standard unit. Such factors as soils, topography, and density of woody species were rated, but the most important single variable was average annual rainfall. (Crouse-Arizona)
W70-01206

COMMUNITY IRRIGATION PROJECTS IN THE WAIKERIE DISTRICT OF SOUTH AUSTRALIA,
Hull Univ. (England).
P. Crabb.
Geography, Vol 52, No 4, p 412-415, Nov 1967. 4 p, 1 fig, 2 tab.

Descriptors: *Arid lands, *Sprinkler irrigation, *Horticultural crops, Salinity, Drainage, Evaporation, Irrigated land, Irrigation programs, Citrus fruits.
Identifiers: *Australia, *Murray River, South Australia.

Over 3,000 acres of the Waikerie District of South Australia have been irrigated since 1960. This land is well above the river level and in no danger of being flooded as had been earlier developed low lands. The area of deep sandy soils is not suited to furrow-irrigation; therefore, a sprinkler irrigation system has been developed. Irrigation is managed on a community cooperative basis rather than by individual land holders. Most of the land is in orchards with some vineyards, and vegetables presently grown among the developing fruit trees. Much of the land is controlled by absentee owners but with resident managers. There are some difficulties with periodic salinity of Murray river waters causing leaf poison and potential drainage problems, resulting in decreased production and fluctuation in the fruit market. However, the author concludes that undoubtedly the projects will be technically and economically successful. (Crouse-Arizona)
W70-01207

THE KHASHM EL GIRBA IRRIGATION SCHEME: A NEW SOCIO-Economic project in the sudan,
Khartoum Univ. (Sudan).
Mutwakil A. Amin.
Professional Geographer, Vol 21, No 3, May 1969, p 150-152. 3 p, 1 fig, 2 ref.

Descriptors: *Semiarid climates, *Irrigation programs, Rural sociology, Economics, Social aspects, Relocation, Agriculture, Dam construction, Rotations, Cotton, Land tenure, Sugarcane, Wheat.
Identifiers: *Sudan, Aswan High Dam.

The article briefly describes relocation of a Nubian community flooded by the Aswan High Dam to semiarid land east of Khartoum. Since rainfall occurs within a month period, a diversion dam with an irrigation project was developed to conserve water and sustain the relocated group of some 32 thousand persons. The soil was a deep fertile clay which with addition of a dependable water supply appears to be able to support a viable agricultural community based on cotton and sugar for export and wheat and vegetables for local consumption. Ownership and farm management activities are divided between settlers and the government according to availability of capital and technical abilities. The settlers are grouped into several villages in an attempt to preserve their former social structures. (Crouse-Arizona)
W70-01208

REGIONAL AND SEASONAL WATER SUPPLY IN THE TARIM BASIN AND ITS RELATION TO CULTIVATED LAND POTENTIALS,
Hawaii Univ., Honolulu.
Herold J. Wiens.
Assn of Amer Geographers, Annals, Vol 57, No 2, June 1967, p 350-366. 17 p, 1 tab, 3 fig, 61 ref.

Descriptors: *Arid lands, *Irrigation programs, *Melt water, *Water yield improvement, *Low-flow augmentation, Agriculture, Salinity, Evaporation, Irrigation canals, Channeling, Drainage programs, Flow rates, Flow control, Rice, Wheat, Glaciers, Snow melt, Deserts, Water resources development.
Identifiers: *China, *Sinkiang, *Tarim basin, Timing (Flow), Oases.

The Tarim Basin in Sinkiang is one of the more important areas where China's Communist regime is finding that application of efficient technology can be effective in increasing usable land and conserving irrigation water. Since rainfall averages less than two inches per year, agriculture depends upon irrigations from glacier and snow melt from the high surrounding mountains. Streams flowing from the mountains carry an annual flow estimated at about 89 billion cubic meters. This is a basis for an estimate of potential limit on agricultural production in the Basin. Summer flows account for fifty to eighty percent of the annual flow. Because of inadequate storage and poor drainage in many irrigated areas, full potential of the water supply has not been realized. Much water is lost to evaporation. Developed cropland in 1963 was seven million acres. With improved technology a potential of 11 million acres is estimated. (Crouse-Arizona)
W70-01210

THE DEVELOPMENT OF THE IRRIGATION ECONOMY OF MENDOZA, ARGENTINA,
Glasgow Univ. (Scotland).
Arthur S. Morris.
American Association of Geographers, Annals, Vol 59, No 1, Mar 1969, p 97-115. 19 p, 10 fig, 30 ref.

Descriptors: *Arid lands, *Irrigated land, *Land tenure, *Economics, *Agriculture, Irrigation efficiency, Diversion dams, Canal seepage, Groundwater, Deep wells, Water costs, Vine crops, Agronomic crops, Water law.
Identifiers: *Argentina, *Agricultural development, Mendoza.

The area around Mendoza in western Argentina is extremely arid but has experienced agricultural development based on irrigation using both surface and groundwater originating in the nearby Andes. The area near Mendoza is the oldest in terms of agricultural development and having a longer growing season, is devoted to vineyards. The farms tend to be small and technologically backward. Share cropping with short-term tenancy is common. Water is supplied by canals from diversion dams, with the amount of water determined by natural river flow. These factors discourage long term investment in technological improvement on crop diversification. More recently developed outlying areas, while less favored by climate, have tended toward more stable ownership of larger holdings, technological improvements and crop diversification. These lands depend to a large extent upon modern wells, which are costly but assure a more dependable supply of water. The landowner is encouraged to invest in technology and diversified crop varieties that will make the most economical use of his water. Recent beginning of large storage dams will probably lead to further development of modern agriculture. (Crouse-Arizona)
W70-01213

TRICKLE IRRIGATION -- A PROMISING SECOND TOOL FOR A BREAKTHROUGH IN FOOD PRODUCTION IN TROPICAL, SUBTROPICAL AND DESERT AREAS,
Food and Agriculture Organization of the United Nations, Bangkok (Thailand).
B. D. van't Woudt.
International Commission on Irrigation and Drainage Bull, p 88-96, July 1968. 7 p, 2 fig, 1 tab, 8 ref, append.

Descriptors: Irrigation, *Irrigation systems, *Irrigation practices, *Hydroponics, *Fertilizers, Crops, Crop production, Saline water, Costs, Drops (Fluids), Foreign research, Agriculture, Agronomic crops, Soil moisture, Agronomy, Salinity, Automatic control.
Identifiers: Israel, Saline agriculture, Trickle irrigation.

A method developed in Israel through which a water-fertilizer mix is continuously dripped on the soil at the base of a crop plant under field conditions is discussed. Noncorrosive plastic tubes are placed on the ground next to the base of crop plants; no soil levelling is required. The tubes, which can be permanent installations, continually drip water-fertilizer mix to plant roots. Control head units with water tap and filter, water meter, and fertilizer tank are located about every 5 acres. The unit requires about 2.5 gal/hr and the system takes 1 to 2.3 atm of pressure. Early results, conclusions from related work, and field observations show that this method may produce high yields, allow water of high salinity to be used, reduce drainage problems, and permit complete automation under field conditions in such a way that water and fertilizer applications meet but not exceed plant needs. Although the cost of installation varies from $1000 to $3000/ha, results may pay for this investment within a short time. (USBR)
W70-01218

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

FLOOD PLAIN INFORMATION, TROUT AND BIJOU CREEKS, SOUTH LAKE TAHOE, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.

Corps Eng Flood Plain Rep, Jul 1969. 23 p, 7 fig, 11 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: South Lake Tahoe (Calif), Standard project flood, Intermediate regional flood.

Flooding of Trout and Bijou Creeks, South Lake Tahoe, California, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-00856

EFFECTS OF CULTIVATION AND GRASS ON SURFACE RUNOFF,
Agricultural Research Service, Coshocton, Ohio. Corn Belt Branch.
Frank J. Dragoun.
Water Resources Res, Vol 5, No 5, p 1078-1083, Oct 1969. 6 p, 2 fig, 3 tab, 8 ref.

Descriptors: Rainfall-runoff relationships, *Grasslands, *Cultivation, *Cultivated lands, *Land management, Watershed management, Soil conservation, Water conservation, Erosion control.
Identifiers: Cultivation effects ((Runoff).

Results of research show the effect of drastic changes in land use on surface runoff from 4-acre watersheds near Hastings, Nebraska. Surface runoff was significantly reduced two years after converting marginal cultivated fields to perennial grass and was equivalent to runoff from native meadow after the third year. Conversely runoff increased greatly the first year after native meadow was placed in cultivation. The significance of these results is evident in the conversion of more than a million acres of marginal cropland to permanent vegetation in the Great Plains and in the proposed conversion of many more acres. (Knapp-USGS)
W70-00863

STATE HIGHWAYS.

Ill Ann Stat ch 121, secs 4-201, 4-201.9, 4-201.13 (Smith-Hurd 1960).

Descriptors: *Illinois, *Highways, *Bridges, *Administrative agencies, Legislation, Construction, Operation and maintenance, Navigable waters, Streams, United States, Contracts, Leases, Rivers, Transportation, Bridge construction.
Identifiers: *Ferries.

The Department of Public Works and Buildings shall have the power (1) to construct, purchase, lease or otherwise acquire, and (2) to operate without charge to the public, ferries over rivers and other waters upon any state highway, whether permanently or temporarily located, until such time as it is deemed feasible and desirable to construct, maintain, and operate bridges across any stream between this state and any adjoining state where such bridge is necessary to connect the federal-aid highway network in this and such adjoining state and enter into agreements with adjoining states, persons, and the United States government in conjunction therewith. (Heckerling-Florida)
W70-00888

DAMS.

SC Code Ann secs 18-5 thru 18-8 (1962).

Descriptors: *South Carolina, *Dams, *Administrative agencies, *Milldams, Riparian rights, Legislation, Legal aspects, Jurisdiction, Local governments, Water law, Water policy, Flood control, Floodgates, Flow control, River regulation, Water control, Water storage, Regulation, Public health, Compensation.
Identifiers: Nuisances.

Persons who construct dams which cause overflow upon the lands of another without first having obtained permission to so flood, or who let off impounded water so as to injure the crops of others are in violation of this section. No person is authorized to keep water on land other than his own. When the general health is threatened by the condition of any milldam, the county commissioners may remove the cause of such nuisance, but the owner must be paid fair compensation for such dam. Commissioners may require use of floodgates on milldams when necessary for the protection of public health or when the drainage of uplands requires same. Provisions of this section do not oust the court of general sessions of jurisdiction to abate any millpond as a nuisance. (Johnson-Florida)
W70-00891

AQUEDUCT ROUTE OPTIMIZATION BY DYNAMIC PROGRAMMING,
Technion - Israel Inst. of Tech., Haifa; and Water Planning for Israel Ltd., Tel Aviv. Water Supply Section.
Nathan Buras, and Ze'ev Schweig.
J Hydrol Div Proc of ASCE, Vol 95, No HY 5, p 1615-1631, Sept 1969. 2 fig, 1 tab, 9 ref.

Descriptors: *Optimization, *Aqueducts, *Routing, *Dynamic programming, *Irrigation programs, Conduits, Laterals, Pumping, Costs, Planning.
Identifiers: Teleghan Aqueduct, Ghazvin Development Project, Iran.

A regional irrigation project supplying water to a number of villages scattered over a relatively flat area was modeled by a series of straight lines across the contours, representing the laterals, and a main conduit crossing these lines. This model was further formulated as a dynamic programming search technique, which yielded the preliminary optimal route of the main conduit. The optimality criterion was minimization of total cost of the aqueduct and the laterals, including the energy necessary for pumping water from the main conduit to supply points above it. The dynamic programming formulation enabled the search for minimum cost sections of the aqueduct route, and the application of the principle of optimality insured the attainment of the overall optimum aqueduct route. This study was done in connection with the planning of the Teleghan Aqueduct, within the Ghazvin Development Project in Iran. (Thiuri-Cornell)
W70-00894

CONDEMNATION BY CITIES, COUNTIES, AND DISTRICTS FOR FLOOD CONTROL OR DRAINAGE.
For primary bibliographic entry see Field 06E.
W70-00895

SIMULATION OF RUNOFF FOR DESIGN OF WATER RESOURCE SYSTEMS,
State Water Plan Development of Water Resources Management, Prague (Czechoslovakia).
Ing Zdenek Kos.
Proc, Int Hydrol Symp, Vol 1, Colo State Univ, p 283-289, Sept 1967. 7 p, 4 ref.

Descriptors: *Synthetic hydrology, *Simulation analysis, *River systems, *Water resources development, *Reservoir design, *Optimization, Hydrologic data, Irrigation practices, Multiple-purpose project, Gaging stations, Withdrawal.
Identifiers: Czechoslovakia.

Simulation studies of Czechoslovak rivers were made. The aim of the study was to choose the best combination and allocation of capacities of reservoirs to various uses in such a way as to generate the maximum net benefits. The design of the water resources system required the simulation of monthly flow records of some hydrologically related stations along with specific irrigation requirements. A multiunit multipurpose water resource system including five gaging stations, three reservoirs, a nonwithdrawal use and withdrawal consumption, was studied. Operating procedures were tested. The operation procedure with two stages of regulation proved best. As the data of the period under study (50 years) covered some critical sequences of low monthly flows and high specific irrigation requirements, the results of most studies with synthetic records gave higher net benefits than those using measured data. (Thiuri-Cornell)
W70-00900

A STOCHASTIC APPROACH TO THE DEVELOPMENT OF A REGULATION PLAN FOR THE GREAT LAKES,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch; and McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 02H.
W70-00902

APPLICATION OF DYNAMIC PROGRAMMING TO THE CONTROL OF WATER RESOURCES SYSTEMS,
Stanford Research Inst., Menlo Park, Calif.
For primary bibliographic entry see Field 06A.
W70-00903

LOWER MISSISSIPPI RIVER BASIN DEVELOPMENT DISTRICT.

Miss Code Ann secs 5956-321 thru 5956-323, 5956-325 thru 5956-327, 5956-329, 5956-330 (Supp 1968).

Descriptors: *Mississippi, *Water conservation, *Water resources development, *Water allocation (Policy), Legislation, Legal aspects, Channels, Surface waters, Flood control, Water supply, Mississippi River Basin, Mississippi River, Federal government, Louisiana, Investigations, Feasibility studies, Cost-benefit analysis, Structures, Construction, Financing, Regulation, Planning, Eminent domain, Public utility districts, Parks, Pollution abatement, Water pollution control.
Identifiers: *Public policy, penalties (Civil).

It is declared as a matter of legislative determination that the waterways and surface waters of the state are among its basic resources; these resources have not been conserved to realize their full use; the utilization, development, conservation, and regulation of such waters are necessary for the purposes of flood control, pollution control, economic development, soil conservation, irrigation, navigation, and pollution abatement; these purposes are, as a matter of public policy, in the best public interest. The Lower Mississippi River Basin Development District is created with the power to: (1) develop in conjunction with appropriate state and federal agencies plans for public works of improvement appropriate to the purposes stated above; (2) acquire engineering surveys, feasibility studies and cost estimates relating to the construction of facilities for controlling, storing, using, and distributing the waters within the Lower Mississippi River Basin; (3) acquire, maintain, and use any property necessary for the purposes of the District; and (4)

finance its operation by specified means. Additional powers of the district include water resources allocation, construction of necessary facilities, water resources conservation, and regulation. (Keith-Florida)
W70-00912

FERRIES.

Ark Stat Ann secs 76-1701 thru 76-1730 (1958).

Descriptors: *Arkansas, *Navigable rivers, *Non-navigable waters, Legislation, Legal aspects, United States, Federal government, Lakes, Administrative agencies, Taxes, Safety, Permits, Regulation, Water rights, Riparian rights, Transportation.
Identifiers: *Public ferries, Tolls, Penalties (Criminal), Licensing.

All ferries over public navigable streams are deemed public ferries. Every person owning the land fronting on a public navigable stream is entitled to keep a public ferry over such stream. All lakes retained as public property by the United States are deemed public navigable streams for the purposes of this act. Specific provisions cover the licensing and taxation of ferries. The ferryman is charged with keeping the ferry in such condition as will insure the safety of his loads. Tolls are specifically regulated. Any private non-navigable stream may by court order be declared a ferry site in the public interest. (Keith-Florida)
W70-00913

COMMENT: EXTENDING THE APPLICATION OF THE LAW OF ACCRETIONS.

Ohio Stat L J, Vol 23, No 4, p 771-773, Fall 1962. 3 p, 22 ref.

Descriptors: *Massachusetts, *Riparian rights, *Accretion (Legal aspects), *Riparian land, Ownership of beds, Beds under water, High water mark, Low water mark, Relative rights, Recreation, Navigation, Legal aspects, Competing uses, Easements, Land tenure, Land use, Beaches, Tidal waters, Judicial decisions.

Michaelson v Silver Beach Improvement Association, 342 Mass 251, 173 NE2d 273 (1961), involved a taking of riparian land by a municipality from private owners for the purpose of creating a public recreational beach. In Massachusetts riparian owners acquire title to adjacent land between the high and low water marks, subject to a public easement for navigation and free fishing. The doctrine of accretion is also operative in Massachusetts, and plaintiff landowners claimed that the artificial creation of the beach by the municipality was analogous to accretion and that ownership of the beach, therefore, inured to plaintiffs. The Supreme Court of Massachusetts agreed with this contention, holding that unless the municipality's project was connected with navigation or fishing, the private landowner had a right to the property or to compensation by the municipality. The author considers this result just, since the theory of riparian property is to encourage the development of private access to the sea. (Kelly-Florida)
W70-00921

CONSTITUTIONAL LAW--COMMERCE CLAUSE--WATER RIGHTS IN THE FLOW OF A NON-NAVIGABLE STREAM ARE PROPERTY RIGHTS,
Joseph H. Widmar.
U Pitt L Rev, Vol 21, No 3, p 548-551, Mar 1960. 4 p.

Descriptors: *Non-navigable waters, *Water rights, *Appropriation, *Compensation, Relative rights, Federal government, Judicial decisions, Preferences (Water rights), Federal jurisdiction, Legal aspects, Dams, Navigable waters, Tributaries, State governments, Streams, Water law, Reservation doctrine, Federal-state water rights conflicts, Jurisdiction, Riparian rights, United States, Riparian land.

Grand River Dam Authority v United States, 175 F Supp 153 (1959), is representative of the difficulties encountered by the courts in balancing the rights of individual landowners along non-navigable streams with the right of the federal government to control navigation. The instant decision held that an individual's rights in a non-navigable stream are property rights which may not be taken by the United States without compensation. Although the trend in recent years has been towards increased governmental immunity along navigable streams, the instant case indicates that the courts are reluctant to extend this immunity to non-navigable waters. It is settled that a private individual has no compensable property rights in the flow of a navigable stream, and there appears to be no justifiable reason for treating landowners along non-navigable streams differently. Upholding such a distinction would greatly increase the cost of and hinder federal water control projects. If the governmental immunity under the commerce clause extends to the taking of water rights on navigable streams, the same reasoning should allow takings on the non-navigable tributaries. (Marsee-Florida)
W70-00922

FEDERAL REGULATION OF WATERWAYS.
Rocky Mt L Rev, Vol 19, No 1, p 49-64, Dec 1946. 16 p, 22 ref.

Descriptors: *Federal jurisdiction, *Navigable waters, *Water rights, *Judicial decisions, Water resources development, Governments, Federal government, Federal-state water rights conflicts, State jurisdiction, Riparian rights, Relative rights, Watershed management, Prior appropriation, Flood control, Streams, Rivers, Water resources, Water law, Navigation, Navigable rivers, Rivers and Harbors Act, Tributaries, River systems, Legal aspects.

The federal government has asserted increasing control over streams and rivers through the Constitution's commerce clause. Congress has the power to regulate interstate commerce on navigable waterways. An early Supreme Court case held that rivers which are navigable in fact are navigable in law. Navigable in fact means susceptible of being used, in their ordinary condition, as highways of commerce. A later case expanded this test so that any stream which may at any time have borne any sort of navigation, in any form, may be termed a navigable waterway. And further, any stream or watershed which contributes to such navigable waterway is subject to federal regulation of commerce. Another Supreme Court decision held that whenever the profits of flood control exceed the costs, federal regulation of tributaries and watersheds is permitted, for watersheds are a key to flood control. The principal corollary effect of these cases is upon the water rights involved. Since water rights are not fifth amendment property and are subject to a dominant public interest in navigation, these rights on almost every stream are subject to destruction without just compensation. (Smith-Florida)
W70-00928

WATER AND WATER COURSES--SERVITUDES--ARTICLE 660, LOUISIANA CIVIL CODE OF 1870.
Tul L Rev, Vol 21, No 4, p 716-718, June 1947. 3 p.

Descriptors: *Louisiana, *Obstruction to flow, *Drainage, *Legislation, Judicial decisions, Remedies, Damages, Flooding, Crops, Flow augmentation, Drains, Surface waters, Surface drainage, Surface runoff, Upstream, Water law.
Identifiers: *Drainage servitude.

In the case of Brown v Blankenship, 28 So 2d 496 (La App 1946), defendant landowner allowed brush and other natural growth to accumulate within a natural drain leading from plaintiff's land. The obstruction caused drainage water to remain on plaintiff's land so as to seriously damage crops growing thereon. Plaintiff sued to have defendant remove the obstruction and place the drain in a condition which would permit water to flow uninterruptedly. The trial court held for plaintiff, and the appellate court affirmed holding that under the Louisiana Code defendant was required to keep the natural drain open even though he had taken no affirmative action to obstruct it. Before this case, litigation over the servitude of drainage has involved affirmative actions which constituted a breach of the obligation created by the servitude. The instant case raises the legal question of whether the servitude of drainage imposes an obligation on the owner of the lower estate to take positive action to keep a drain clear of natural obstructions. Under the Civil Code, there is no duty to take any affirmative action to preserve the natural drainage. Therefore, it would seem that defendant owed the plaintiff no duty to take any affirmative action to prevent the natural obstruction. (Heckerling-Florida)
W70-00929

NAVIGABLE WATERS--ARTIFICIAL LAKE CONNECTED TO RIVER,
Donald Eugene Chaney.
Mo L Rev, Vol 24, No 3, p 392-393, June 1959. 2 p, 10 ref.

Descriptors: *Missouri, *Navigable waters, *Artificial watercourses, *Easements, Judicial decisions, Legal aspects, Mississippi River, Overflow, Banks, Dams, Fishing, Navigation, Federal government, Lakes, Relative rights.
Identifiers: *Public easements, Drainage ditches, Dedication.

Defendant created an artificial lake on his land and used it as a fishing resort. When the federal government constructed a dam on the Mississippi River, the water level of the artificial lake rose sufficiently so that it was possible to get a boat from the plaintiff's land across defendant's lake to the river. The plaintiff sued to force defendant to remove from his lake a pontoon bridge, and the trial court found for the defendant. The St. Louis Court of Appeals in Sneed v Weber, 307 SW2d 681 (St L Ct App 1957), held that defendant's lake was not navigable and not subject to a public easement of navigation. This was in line with the general rule that, subject to certain qualifications imposed by the commerce clause, an artificial body of water created by a private person on a site owned by him and not previously occupied by a body of navigable water, even though in fact usable for commerce, is not subject to rights of navigation by others unless the public acquires a right of navigation by dedication, which may be inferred from acquiescence in public use, or unless particular persons acquire an easement of navigation by prescription. (Keith-Florida)
W70-00937

DRAINAGE (CHICAGO SANITARY DISTRICT).

Ill Ann Stat ch 42, secs 362 thru 365, 368, 370, 372a, 381 (Smith-Hurd 1956).

Descriptors: *Illinois, *Lake Michigan, *Sanitary engineering, *Public health, Legislation, Regulation, Administration, Sewage, Sewage treatment, Locks, Dams, Canals, Navigation, Channels, Channel improvement, Municipalities, Taxes, Assessments.

The board of trustees of the sanitary district of Chicago may provide for the drainage of additional territory added to the district. The board may provide channels, drains, and ditches for carrying off sewage. The district's powers and jurisdiction over added territory shall be the same as that vested in it over the territory already included within the limits

of said sanitary district. The district shall permit all watercraft navigating the Illinois and Michigan canal to navigate the water of all channels of the sanitary district without delay and without payment of tolls. The district has no power to levy and collect any special assessment or tax upon any part of the added territory. The district may construct all dams north of the upper basin of the Illinois and Michigan canal as may be deemed necessary. (Moulder-Florida)
W70-00940

DRAINAGE-SELECTION, QUALIFICATIONS, POWERS, AND DUTIES OF COMMISSIONERS AND OTHER OFFICERS.
Ill Ann Stat ch 42, secs 4-1 thru 4-39 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Drainage districts, *Drainage systems, *Administrative agencies, Legislation, Legal aspects, Drainage, Regulation, Compensation, Surveys, Construction, Maintenance, Drains, Levees, Eminent domain, Floods, Condemnation value, Right-of-way, Pumping plants, Repairing, Leases, Planning, Dredging, Easements, Assessments, Overflow, Loans, Financing, Wildlife management.

The elections of and qualifications for commissioners of drainage districts are provided for. The commissioners are under the supervision of the court, and many of their actions are subject to review by the court. The commissioners are empowered to: (1) use district funds for any lawful purpose; (2) do all acts necessary for the purpose of surveying, constructing, altering, enlarging, repairing, and maintaining any drain, levee, or other work of the district; (3) exercise the power of eminent domain to accomplish the foregoing purposes; and (4) enter into agreements with any state agency relative to the use and control of ditches, drains, levees, and drainage structures for the purpose of fish and game management. The commissioners are under a duty to keep the drains, levees, pumping plants, and other works of the district in operation and repair. The manner in which the commissioners are to finance the operations of the district is specified; in particular, the commissioners are empowered, subject to court approval, to levy assessments for specified purposes. The commissioners may build up and maintain an emergency fund to meet emergencies arising from flood, overflow, or acts of God. (Keith-Florida)
W70-00941

WATER-DRAINAGE AND LEVEE DISTRICTS.
Ark Stat Ann secs 21-101, 21-406, 21-407, 21-408 (1968).

Descriptors: *Obstruction to flow, *Arkansas, *Rivers, *Non-navigable waters, Salvage value, Navigation, Navigable rivers, Legislation, Drainage districts, Ditches, Drains, Levees, Legal aspects, Costs.
Identifiers: Penalties (Criminal).

The Cache River is declared a non-navigable river. It shall be unlawful for anyone to fell trees or timber in such a manner as to clog drains or ditches. Violation of this provision is a misdemeanor. Anyone who removes such obstruction has a cause of action for the costs of removal against the one causing the obstruction. (Darragh-Florida)
W70-00942

DRAINAGE DISTRICTS.

Miss Code Ann secs 4675, 4710, 4721, 4739, 4744 (1956).

Descriptors: *Mississippi, *Drainage districts, *Drainage programs, *Drainage engineering, Legislation, Eminent domain, Right-of-way, Taxes, Tax rate, Assessments, Condemnation, Utilities, Legal aspects, Channels, Ditches, Diversion structures, Levees, Overflow, Canals.

A procedure for creating drainage districts on petition of one-fourth of the landowners in the proposed district is authorized. Three temporary commissioners shall be appointed and shall have the power: (1) to select a competent engineer to survey the region and make suggestions; (2) borrow money to pay preliminary expenses; and (3) issue negotiable notes. All preliminary expenses of the drainage district shall be paid out of the proceeds of the first assessment levied under this article. Any landowner within the district may build ditches to drain his lands into the public ditches. The Board of Commissioners may condemn a right-of-way for such ditch. The Commissioners of the district may carry the ditches across, under, or through any highway, railroad, or utility lines. Districts created to control overflow and surplus water of rivers and their tributaries may additionally construct by passes to convey surplus waters by artificial means by a shorter route from tributaries to the main water course. This statute is not to be construed as changing the law with reference to the disposition and diversion of waters. (Schram-Florida)
W70-00952

SWAMP LAND DISTRICTS.
Miss Code Ann secs 4757 thru 4757-03 (1956).

Descriptors: *Mississippi, *Swamps, *Drainage districts, *Administrative agencies, Drainage, Channels, Legislation, Taxes, Tax rate, Assessments, Federal government, Administration, Government finance, Water districts, Channel improvement, Maintenance, Operation and maintenance, Legal aspects, Financing.

The swamp land districts previously organized by statute shall continue to operate. The adoption of this code shall not repeal such laws insofar as any of such districts are concerned. If there are no commissioners of such a swamp land district now in office, the county board of supervisors shall appoint three commissioners for a period of four years. The commissioners shall have control and management of all of the affairs of such swamp land district and shall have the power and authority: (1) to make improvements to and maintain existing drainage channels; (2) to contract and cooperate with any appropriate agency of the United States in so improving or maintaining any such channels; and (3) to expend the funds of such district. When recommended by the commissioners, the county board of supervisors may levy an annual tax on land in the district not to exceed twenty cents per acre in any one year. Said commissioners shall have full power and authority to do and perform all acts necessary and desirable in carrying out the purposes of this act. (Schram-Florida)
W70-00953

FLOOD CONTROL - DRAINAGE DISTRICTS.
Miss Code Ann secs 4763, 4765-4766-03 (1956).

Descriptors: *Mississippi, *Flood control, *Drainage districts, *Eminent domain, Condemnation, Easements, Right-of-way, Taxes, Tax rate, Assessments, Drainage engineering, Ditches, Drainage programs, Construction, Federal government, Legislation, Maintenance, Operation and maintenance, Maintenance costs, Administrative agencies, United States, Legal aspects.

The commissioners of any drainage district are authorized to give assurances to the federal government that all flood control works constructed by the United States will be maintained without expense to the United States. Said commissioners may accept for the district any conveyance of lands, such lands to be rented, leased, or conveyed for the benefit of the district. Such lands, when vested in the district, are subject to taxation as are other lands. The commissioners are authorized to fix and levy an annual ad valorem tax not exceeding two mills on real and personal property to defray maintenance of flood control works. The commissioners may also assure the United States that they will furnish rights-of-way for all levees and drainage ditches constructed by the United States. The districts may acquire such rights-of-way by condemnation and eminent domain. The commissioners may levy an annual ad valorem tax not exceeding two mills for the purpose of defraying and expenses of acquiring said rights-of-way. (Schram-Florida)
W70-00954

TOMBIGBEE RIVER VALLEY WATER MANAGEMENT DISTRICT.
Miss Code Ann secs 5956-131, 5956-132, 5956-134, 5956-135, 5956-137 thru 5956-141, 5956-144, 5956-151 (Supp 1968).

Descriptors: *Mississippi, *Water resources development, *Water conservation, *Water utilization, Legislation, Legal aspects, Administrative agencies, Financing, Surface waters, Overflow, Natural resources, Regulation, Recreation, Public policy, Beneficial use, Impounded waters, Eminent domain, Taxes, Planning, Wildlife conservation, Contracts, Water supply, Flood control, Pollution abatement.
Identifiers: *Water management districts, Tombigbee River, Penalties (Criminal).

To conserve the state water resources for the realization of its full beneficial use especially with regard to the Tombigbee River Valley, the Tombigbee River Valley Water Management District is created and established. The method by which a county within the Valley may become a member of the District is provided. The powers of the District are explicitly enumerated and those powers include: public works planning to accomplish water resources development; the impoundment of overflow and surface waters for specified purposes; construction and maintenance of necessary facilities; the power of eminent domain; and the power to contract for specified purposes. The District may provide for public parks, recreation facilities, and wildlife conservation. The directors of the District are empowered to promulgate regulations, applicable within the District, regarding water pollution, the waste of water, and recreational privileges. All counties which are members of the District will pay two mills of all ad valorem taxes due the state to the District. The District is empowered to issue bonds for specified purposes. The District may cooperate with other governmental agencies to accomplish the purposes of this Act. (Keith-Florida)
W70-00955

TOMBIGBEE RIVER VALLEY WATER MANAGEMENT DISTRICT.

Miss Code Ann secs 5956-131, 5956-132, 5956-134, 5956-135 (Supp 1968).

Descriptors: *Mississippi, *Water resources development, *Water conservation, *Water utilization, Legislation, Legal aspects, Surface waters, Watercourses (Legal), Overflow, Natural resources, Regulation, Flood control, Water supply, Pollution abatement, Irrigation, Navigation, Recreation, Tributaries, Public policy, Flood damage, Beneficial use, Impounded waters, Cities, Eminent domain, Administrative agencies, Planning.
Identifiers: *Water managment districts, Tombigbee River.

It is declared as a matter of legislative determination that water resources in the state have not been conserved to realize their full beneficial use. The utilization, development, conservation, and regulation of such waters are necessary to insure: an adequate flood control program, sanitary water supply, fulfillment of irrigation needs, and improvement of navigation and pollution abatement. To carry out the foregoing purposes with regard to the Tombigbee River Valley, the Tombigbee River Valley Water Management District is authorized; the makeup of the board of directors of said District is provided for, and the manner in which counties may get into the District is provided for, and

the manner in which counties may get into the District is set forth. When six counties have entered the District, it will be created as an agency of the state. The enumerated powers of the District include the power to: develop in conjunction with other government agencies plans for public works for the purposes of floodwater damage prevention or the conservation, development, navigation, utilization, and disposal of water; impound overflow water and the surface water of the Tombigbee River and its tributaries for the control, storage, preservation, or distribution of such waters; condemn land for the purposes of this act; overflow public lands within the District; and do any other acts necessary to accomplish the purposes of this act. (Keith-Florida)
W70-00956

TOMBIGBEE RIVER VALLEY WATER MANAGEMENT DISTRICT.

Miss Code Ann secs 5956-137, 5956-138 thru 5956-141, 5956-144, 5956-151 (Supp 1968).

Descriptors: *Mississippi, *Water resources development, *Financing, *Water utilization, Legislation, Legal aspects, Surface waters, Watercourses (Legal), Natural resources, Regulation, Water supply, Recreation, Reservoirs, Wildlife conservation, Easements, Fishing, Boating, Permits, Taxes, Administrative agencies.
Identifiers: *Water management districts, *Tombigbee River, Public parks, Penalties (Criminal).

The Tombigbee River Valley Water Management District is authorized to provide for public parks, recreation facilities, and wildlife preservation. It may acquire land within the project area for such purposes. The District's Board of Directors is empowered to promulgate all reasonable regulations to secure, maintain, and preserve the sanitary condition of all water flowing into any District reservoir, to prevent the waste or unauthorized use of water, and to regulate all recreational and business privileges exercised within the District. The District is empowered to obtain an appropriation permit from the State Board of Water Commissioners. So long as the District has obligations outstanding, each member county will pay to the District two mills of all ad valorem taxes due by the county to the state and one-half mill on all of the cougty's taxable property within the District. An additional levy of two mills may be made by the counties for the District in specified circumstances. The District's board of directors is empowered to borrow money or issue District bonds for the purpose of financing the District's operations. The District is empowered to act jointly with other political subdivisions to implement the purposes of this act. (Kieth-Florida)
W70-00957

BIG BLACK RIVER BASIN DISTRICT.

Miss Code Ann secs 5956-221 thru 5956-223, 5956-225 thru 5956-228, 5956-230, 5956-231, 5956-234 (Supp 1968).

Descriptors: *Mississippi, *River basins, *Administrative agencies, *Water resources development, Rivers, Taxes, Tax rates, Leadership, Legislation, State governments, Federal government, Overflow, Dams, Erosion control, Floodwater, Flood protection, Flooding, Flood control, Recreation facilities, Parks, Appropriation, Eminent domain, Forests, Soil conservation, Tributaries.
Identifiers: *River basin districts.

To conserve, store, and regulate the waters of the Big Black River and its tributaries and their overflow waters, this act authorized the organization of the Big Black River Basin District. The Act provides for the selection and composition of a board of directors for such district and establishes procedure for the District's creation. Counties becoming members of the District are required to make annual payments thereto from funds raised by special tax levy. Numerous powers are given the District, including the power: (1) to impound and appropriate overflow and surface waters of the Big Black River and its tributaries; (2) to forest and reforest; (3) to prevent soil erosion; (4) to acquire lands by condemnation; (5) to require relocation of roads, railroads, power lines, and other named facilities; (6) to inundate public lands; (7) to establish and operate necessary facilities; and (8) to establish public parks and recreation facilities. The Act further gives the board of directors power to promulgate regulations for the District and sets forth penalties for violations thereof. The District may also borrow money and issue bonds. (Marsee-Florida)
W70-00961

BIG BLACK RIVER BASIN DISTRICT.

Miss Code Ann secs 5956-221 thru 5956-223, 5956-225, 5956-226, (Supp 1968).

Descriptors: *Mississippi, *River basins, *Administrative agencies, *Water resources development, Soil conservation, Rivers, Taxes, Tax rates, Financing, Leadership, Legislation, State governments, Overflow, Erosion control, Dams, Floodwater, Flood protection, Flooding, Flood control, Recreation facilities, Parks, Forests, Forestry, Tributaries.
Identifiers: *River basin districts.

The purposes of this Act are to conserve, store, and regulate the waters and overflow waters of the Big Black River and its tributaries for: (1) commercial, municipal, industrial, agricultural, and manufacturing purposes; (2) recreational purposes; (3) flood control; (4) timber development and irrigation; (5) navigation; (6) soil conservation; and (7) pollution abatement. Toward these purposes the Big Black River Basin District is authorized to be organized. All powers of the District shall be exercised by a board of directors to be selected and composed as herein provided. The District shall be created by the procedures set forth in this Act, after which creation any county may, through its board of supervisors, become a member. Counties becoming members of the District are required to make annual payment thereto from funds raised by special tax levy. (Marsee-Florida)
W70-00962

BIG BLACK RIVER BASIN DISTRICT.

Miss Code Ann secs 5956-227 thru 5956-228, 5956-230, 5956-231, 5956-234 (Supp 1968).

Descriptors: *Mississippi, *River basins, *Administrative agencies, *Water resources development, Rivers, Financing, Contracts, Legislation, State governments, Federal government, Overflow, Dams, Erosion control, Floodwater, Flood protection, Flood control, Recreation facilities, Parks, Appropriation, Eminent domain, Forests, Soil conservation, Tributaries, Grants.
Identifiers: *River basin districts.

The Big Black River Basin District is empowered to: (1) develop, in conjunction with federal and state agencies, plans for the conservation, development, storage, and regulation of soil and waters within the Pearl River Basin; (2) develop waters for navigation and prevention of flood damage; (3) acquire property by purchase, lease, or gift; (4) obtain grants and loans from the United States; (5) contract; (6) make surveys relating to the construction of dams and reservoirs; (7) impound for beneficial use the surface water of the Big Black River and its tributaries; (8) forest and reforest, and prevent erosion and flood within the District; (9) store and preserve waters for irrigation and prevention of water pollution; (10) acquire property interests by eminent domain; (11) require the relocation of roads and highways, railroad lines, telephone and telegraph lines, properties, electric power lines, gas pipelines, and mains and facilities; (12) inundate public lands; (13) issue bonds; (14) fix and collect charges for services, facilities, or commodities furnished by the District; (15) lease or sell property; (16) cooperate with other governmental agencies; and (17) establish public parks and recreation facilities. (Marsee-Florida)
W70-00963

LOWER YAZOO RIVER BASIN DISTRICT.

Miss Code Ann secs 5956-351 thru 5956-353, 5956-355 thru 5956-358, 5956-360, 5956-361, 5956-369 (Supp 1968).

Descriptors: *Mississippi, *River basin development, *Water districts, *River basin commissions, Legislation, Taxes, Operating costs, Tax rate, Assessments, Surface waters, Overflow, Water conservation, Fish conservation, Wildlife conservation, Optimum development plans, Water pollution, Dams, Canals, Reservoirs, Condemnation, Easements, Construction, Right-of-way. Financing, Water pollution control, Flood control.

Authority is given to organize the Lower Yazoo River Basin District to utilize, develop, conserve, and regulate the waters of that river. Provisions are made for the appointment of a Board of Directors who shall exercise all powers of the District. The creation of the District is dependent upon its ability to get at least three counties to join. Provisions describing the procedure for membership are detailed. Once the District is established, a tax levy of one-half mill is authorized within each member county to support the projects of the District. The District is empowered to: (1) make bylaws and regulations; (2) acquire land; (3) make feasibility studies; (4) impound and appropriate water from the river for beneficial use; (5) construct needed facilities; and (6) acquire by condemnation any easement or property needed. A number of qualifications to these powers are included. Additionally, the District is authorized to provide for the preservation of fish and wildlife, secure sanitary water conditions, and prevent pollution. The power to borrow money and issue bonds is granted. (Schram-Florida)
W70-00964

LOWER YAZOO RIVER BASIN DISTRICT.
Miss Code Ann secs 5956-351 thru 5956-353, 5956-355, 5956-356 (Supp 1968).

Descriptors: *Mississippi, *River basins, *River basin development, *River basin commissions, Water districts, Legislation, Taxes, Operating costs, Tax rate, Payment, Income, Assessments, State governments, Surface waters, Surface runoff, Overflow, Water conservation, Administration, Optimum development plans, Water law, Flood control, Financing.

Provisions are made for the organization of the lower Yazoo River Basin District to utilize, develop, conserve, and regulate the overflow and surface waters of the Lower Yazoo River. A Board of Directors is authorized and all powers of the District are to be exercised by them. Provisions for appointment of members, their compensation, and election of officers are made. If any county desires to become a member of the District, it must provide for an election to do so and approve a special ad valorem tax of one-half mill on all taxable property in the county. When three counties have become members of the District in the manner provided, such District will then become created as an agency of the State. Each county which becomes a member of the District shall pay its pro rata share of the budgetary requirements of the District. Such share shall not exceed the avails of the levy of one-half mill on all taxable property in the county. Additional provisions include the methods of payment and authorization for the taxing power. (Schram-Florida)
W70-00965

LOWER YAZOO RIVER BASIN DISTRICT.
Miss Code Ann secs 5956-357, 5956-358, 5956-360, 5956-361, 5956-369 (Supp 1968).

Descriptors: *Mississippi, *River basin commissions, *Water districts, *River basin development, Legislation, Condemnation, Navigation, Construction, Easements, Right-of-way, Wildlife conservation, Fish conservation, Water pollution, Water conservation, Federal government, Dams, Canals, Reservoirs, Water pollution control, Recreation facilities, Programs.

The Lower Yazoo River Basin District, through its Board of Directors, is empowered to establish plans for public works of improvement for the development of waters in the district for navigation, industry, commerce, and shipping. Additional powers include the right: (1) to make by laws and regulations; (2) to acquire land; (3) to make feasibility studies; and (4) to exercise any other rights inherent to a corporate body. When the district has developed plans for a project, additional powers shall come into being in relation to such project. These include the right: (1) to impound and appropriate for beneficial use water of the river; (2) to construct all facilities deemed necessary; and (3) to acquire by condemnation any needed property. A series of limitations and qualifications to these powers are included. The district is authorized to provide for the preservation of fish and wildlife and to acquire land otherwise than by condemnation for such purposes. The directors are empowered to promulgate regulations to secure sanitary water conditions, prevent waste, and prevent pollution. The board may borrow money and issue bonds and notes to carry out the duties of this act. (Schram-Florida)
W70-00966

WESTPHAL V SCHMALZ (UNAUTHORIZED USE OF DRAINAGE SYSTEM).
169 NW2d 401-403 (Minn 1969).

Descriptors: *Drainage, *Minnesota, *Watersheds (Basins), *Drainage systems, Excess water (Soils), Judicial decisions, Tile drainage, Ditches, Drainage engineering, Drainage water, Land management, Watersheds (Divides), Flood control, Riddance (Legal aspects), Drains, Subsurface drains, Flood damage, Floods, Overflow, Agricultural watersheds, Damages, Assessments, Benefits, Project benefits, Relative rights, Legislation, Legal aspects.

Defendant landowner drained part of his tract into a judicial ditch system serving another part of his tract and plaintiff's tract. The land drained was not within the watershed served by the system and therefore was not assessed for benefits. Defendant cut across the watershed line with a tile drain to connect with an existing outlet in a part of his land within the watershed. Due to the increased pressure and volume of water in the extension serving plaintiff's land, a portion of his tract was flooded after a heavy rainstorm causing flood damage to his crops. Plaintiff was granted a permanent injunction and damages. The applicable statute required a ditch system be used only when the land was assessed for benefits in the original judicial proceedings which established the ditch or when express authority was secured from the proper court or agency. This portion of defendant's tract was not within the watershed, and drainage of the land was not authorized under the statute. (Douberley-Florida)
W70-00971

CONDEMNATION BY CITIES AND COUNTIES TO PROVIDE WATERSHEDS OR BEDS FOR WATER PIPES.
Va Code Ann sec 25-232 (1969).

Descriptors: *Virginia, *Condemnation, *Local governments, *Watersheds (Divides), Large watersheds, Small watersheds, Land use, Land tenure, Control, Eminent domain, Right-of-way, Easements, State jurisdiction, Costs, Pipes, Legislation, Legal aspects.

The governing body of any city or town may acquire by condemnation such lands or rights-of-way as may be necessary for providing watersheds for the use of such city or town and may acquire the necessary lands or rights for laying water pipes from such watersheds. The power of condemnation may be used where terms of purchase of the land cannot be agreed upon due to the incapacity of the owner or due to an inability to find the owner within this state. (Kelly-Florida)
W70-00973

EFFECT OF CHANGES OF STREAMFLOW REGIMEN ON RESERVOIR YIELD,
State Univ. of New York, Syracuse. Water Resources Center.
Richard H. Hawkins.
Water Resources Res, Vol 5, No 5, p 1115-1119, Oct 1969. 5 p, 4 fig, 1 tab, 8 ref.

Descriptors: *Reservoir yield, *Streamflow, *Reservoir operation, Reservoir storage, Water management (Applied), Water yield, Regimen, Systems analysis, Synthetic hydrology, Hydrographs.
Identifiers: Streamflow regimen changes.

A presumptive approach was used to gain insight into the question: How do alterations of streamflow characteristics affect downstream objectives. The special ease of flows changed in timing and volume from management on the tributary watershed in tandem combination with a downstream reservoir was considered. Change in mean yield of the reservoir was taken as an index of utility of the streamflow changes. Uniform increases of streamflow of 5% and 15% and a half month delay in the annual hydrograph were assumed either singly or in combination, storage yield computations made, and differences in yields determined. Not all extra streamflow was found to be useful although the increases gained utility with increasing storage availability. A timing delay was most important with smaller storage availability and then only to a limited degree. Flow increases combined with a timing delay produced results that were approximately simple additions to the two individual effects. (Knapp-USGS)
W70-01001

A WATER DISTRIBUTION SYSTEM FOR COLD REGIONS, The Single Main Recirculating Method. An Historical Review, Field Evaluation, and Suggested Design procedures,
Alaska Univ., College. Inst. of Water Resources.
R. Sage Murphy, and Charles W. Hartman.
Available from the Clearinghouse as PB-187 685, for $3.00 in paper copy, $0.65 in microfiche. Project Completion Report, Institute of Water Resources Report No IWR-8, March 1969. 78 p, 2 tab, 19 fig, 69 ref. OWRR Proj A-018-ALAS.

Descriptors: *Distribution systems, *Pipelines, Water distribution, Arctic, Cold weather construction.
Identifiers: *Arctic water distribution system.

The report describes the single-main recirculating water distribution system used in arctic and subarctic communities to prevent water main freezing. An historical review, data from a prototype installation, and recommended design procedures are included for Far North facilities. The field data was obtained at Unalakleet, Alaska, a community on Norton Sound, an arm of the Bering Sea. Over a year of continuous data were obtained starting at the time the installation was constructed in 1965. The described facility is one of three presently in existence.
W70-01088

BASIC WATER USE DOCTRINES AND STATE WATER CONTROL AGENCIES.

Am Water Wks Ass'n J, Vol 42, No 8, p 755-760, Aug 1950. 6 p, 1 ref.

Descriptors: *Water policy, *Administrative agencies, *Groundwater, *Surface waters, Water law, State governments, Legal aspects, Interstate compacts, Riparian rights, Appropriation, Reasonable use, Colorado River Compact, Water rights, Water resources, Legislation, Water pollution, Pollution abatement.

Basic water law for both surface and ground water is discussed including the riparian doctrine, appropriation doctrine, common law rule, rule of reasoable use, and appropriation doctrine. Also discused are the state water control agencies which approve water uses. The functions of these agencies are divided into the following categories: (1) surface water; (2) ground water; (3) dams and diversion works; (4) water quality and treatment (public supplies); (5) water quality and treatment (industrial drinking water); (6) stream pollution control; (7) sewage disposal (technical); and (8) industrial waste disposal (technical). Statistical information is presented concerning states having agencies exercising control over surface or groundwater. Briefly examined are several interstate compacts and agreements for the control and development of water resources. (Gabrielson-Florida)
W70-01131

APPROPRIATION WATER LAW ELEMENTS IN RIPARIAN DOCTRINE STATES,
For primary bibliographic entry see Field 06E.
W70-01134

WISCONSIN LAW OF WATERS,
Adolf Kanneberg.
Wis L Rev, Vol 1946, No 2, p 345-393, Mar 1946. 4 p, 151 ref.

Descriptors: *Wisconsin, *Water management (Applied), *Navigable waters, *Administrative agencies, Navigation, Saw log test, Floatable streams, Riparian rights, Dams, Non-navigable waters, Ownership of beds, Federal government, Navigable rivers, Water levels, Water control, Water law, Administration, Permits, Regulation, Legal aspects.

The determination and regulation of 'navigable waters' differs widely within the federal system. Federal definitions make navigable waters public highways, but fail to designate what waters are navigable. Wisconsin adopted the riparian doctrine of water law but has depended on case law and statutes in developing a definition of navigable waters, concluding that streams navigable in fact are public and that those non-navigable in fact for any reason are private property. Although beds under navigable streams may be owned by the respective riparians, those rights of ownership are subject to a public right of navigation. Wisconsin has vested control over navigable waters in the Public Service Commission with power to: (1) regulate the flow and level of water in streams; (2) issue permits to construct dams on navigable streams; (3) issue permits for diversion of surplus water from one watershed to another; (4) authorize bridges over navigable streams; (5) abate unlawful obstructions in navigable waters; (6) contract for the removal of sand, gravel, and marl from beds of navigable lakes; (7) supervise water control for Milldam Act dams; (8) regulate dams on non-navigable streams. (McDonough-Florida)
W70-01138

THE NAVIGATION SERVITUDE AND JUST COMPENSATION: STRUGGLE FOR A DOCTRINE,
Richard W. Bartke.
Ore L Rev,Vol 48, No 1, p 1-24, Dec 1968.

Descriptors: *Federal jurisdiction, *Condemnation, *Compensation, *Condemnation value, Proprietary power, Riparian rights, Water rights, Easements, Admiralty, Benefits, Water resources, Water resources development, Water, Water law, Navigable waters, Navigable rivers, Legislation,

Water policy, Planning, Eminent domain, Judicial decisions.

The national sovereignty over navigable waters, called the 'navigation servitude,' is similar to an easement and is derived from the Constitution's commerce clause and grant of admiralty jurisdiction. These provisions entitle the federal government to the use and benefit of the bed, banks, and water of any navigable watercourse and have conferred upon the federal government a proprietary interest in the navigable waters of the nation. The problem exists as to what compensation is required by the fifth amendment to be paid for the taking of 'last lands,' or lands just above the ordinary high water mark. The sovereign does not have to pay for what it owns. So where condemned land has added value because of a possible water-power site, no additional compensation is paid. The water power is subject to the navigation servitude, so no private party has an interest therein. Where partial flooding of land would increase the value of the remainder of the land, this increase can be deducted from the compensation for the flooded portion. But if the remainder were also flooded later, only the original value would be awarded. Various other types of awards have also confused and clouded the law. (Smith-Florida)
W70-01144

THE NAVIGATION SERVITUDE AND JUST COMPENSATION: STRUGGLE FOR A DOCTRINE,
Richard W. Bartke.
Ore L Rev, vol 48, no 1, p 24-44, Dec 1968.

Descriptors: *Federal jurisdiction, *Condemnation, *Federal Power Act, *Compensation, Easements, Planning, Condemnation value, Proprietary power, Riparian rights, Water rights, Navigable waters, Water policy, Navigable rivers, Water resources, Benefits, Water, Water law, Judicial decisions, Legislation, Admiralty, Water resources development.

Certain state governments, local governmental bodies, or private parties may invoke the navigation servitude through the federal eminent domain power as a licensee under the Federal Power Act. A licensee likewise will have to pay just compensation for property taken, but not for interests attributable to the navigation servitude. Under section 21 of the Federal Power Act, Congress donated parts of the public domain for the purpose of power development. If any charge is made for these donations, such charge should be reflected in either payments to the federal treasury or lower power rates to consumers. Section 21 should be construed as putting a Federal Power Commission licensee in the same position as the United States, with the same power of eminent domain. The use of water has been rapidly increasing. Therefore, it is becoming more important that planning be comprehensive for an entire basin. In this planning the navigation servitude may be of crucial importance. Once the courts admit that the federal navigation servitude is proprietary in nature, many of the problems involving water rights will be resolved. (Smith-Florida)
W70-01145

STOUDER V DASHNER (DOMINANT VERSUS SERVIENT LAND RIGHTS RELATING TO DRAINAGE OF SURFACE WATERS).
49 NW2d 859-866 (Iowa 1951).

Descriptors: *Iowa, *Surface runoff, *Drainage water, *Obstruction to flow, Surface drainage, Channels, Water spreading, Overland flow, Floods, Drainage, Runoff, Surface-groundwater relationships, Surface waters, Percolating water, Subsurface runoff, Relative rights, Remedies, Legal aspects, Judicial decisions.

Plaintiff upper landowner brought action against defendant lower landowner and others to enjoin them from maintaining obstructions that prevented surface flood waters from draining from plaintiff's land onto defendant's land. Defendant filed a counterclaim for damages and prayed for an injunction for removal of a concrete tube located under a railroad embankment. The original rule in Iowa concerning drainage of surface waters has been modified in the interest of agriculture to the extent that the owner of the higher land may drain his land into a natural watercourse without liability to a lower proprietor for resulting damages, even if the effect is to throw the surface water in somewhat increased volume on the servient estate. A definite channel is not essential to definition of a watercourse. A dominant proprietor may, through use of a ditch, cause water to flow in its natural direction instead of over the surface or by percolation where no new watershed is tapped and where no addition to the former volume is caused by said ditch outside of what formerly reached the same point on the servient tract over a wider surface. Based on this rule the trial court held for the plaintiff and was affirmed by the Supreme Court. (Moulder-Florida)
W70-01146

ROCKLAND COUNTY ANTI-RESERVOIR ASS'N V DURYEA (PREVENTION OF RESERVOIR CONSTRUCTION).
282 App Div 457, 123 NYS2d 445-452 (Sup Ct 1953).

Descriptors: *New York, *Reservoirs, *Reservoir construction, *Water works, Legislation, Regulation, Reservoir yield, Usable storage, Reservoir sites, New Jersey, Safe yield, Water distribution (Applied), Water supply, Water yield improvement, Judicial decisions, Reservoir operation, Reservoir storage, Relative rights.

Spring Valley Water Works, a wholly owned subsidiary of Hackensack Water Company, supplies water to communities in Rockland County. Spring Valley Water Works determined that due to the expanding population and industrial water requirements of the area, more water was needed to meet the area's needs. Following their petition, the Company received permission to construct a reservoir from the Water Power and Control Commission. This decision was challenged, with the principal contention being that the reservoir would have greater capacity than required and that the project was for the primary benefit of the water company. This contention was rejected by the Commission, which stated that an additional source of water was essential to assure Spring Valley an adequate supply for present and future needs. The benefit to the Company was substantial but a necessary, incidental effect of the project. In a review of this decision, the court found that the Commission's findings upon the subject of the project's 'public necessity' were adequate. The Commission did not have to make findings upon the question of comparative well and reservoir costs or the effect of the reservoir on the consumer water rates. Section 396 of the conservation law was found to be constitutional. (Moulder-Florida)
W70-01147

JURISDICTION OF COUNTY DRAINAGE BOARDS.
Ind Ann Stat secs 27-2201 thru 27-2206 (Supp 1968).

Descriptors: *Indiana, *Drainage systems, *Administrative agencies, *Jurisdiction, Drains, Drainage districts, Local governments, Cities, Assessments, Water districts, Riparian rights, Flood control, Maintenance, Benefits, Legislation, Legal aspects.

Legal drains are under the jurisdiction of the county drainage board in each county. Legal drains located within a conservancy district are not subject to this act unless they flow directly or indirectly into any legal drain subject to this act. In such case, the board will assess the lands within the conservancy district to the extent benefited. Legal drains that are part of a flood control project are not within the jurisdiction of this act. Private and mutual drains, and city or unincorporated town drains are not subject to this act, but the lands drained may be assessed for improvements to a legal drain if such lands are also drained by a legal drain. Any or all owners of lands affected by a mutual drain may request the board to assume jurisdiction over the drain and declare it a legal drain. Upon request, the board may determine if drainage maintenance and repair districts or associations formed to maintain and repair drains are no longer active. On finding that such districts or associations are no longer active, the board may declare the drains to be legal drains and assume jurisdiction over them. (McDonough-Florida)
W70-01150

FLOOD CONTROL.
Miss Code Ann secs 4767, 4767.3, 4767.7, 4768 (1956), as amended, (Supp 1968).

Descriptors: *Mississippi, *Flood control, *Channel improvement, *Local governments, Cutoffs, Dams, Levees, Eminent domain, Taxes, Tax rate, Assessments, Condemnation, Easements, Right-of-way, Construction, Legislation, Mississippi River, Federal government, National parks, National memorials, Drainage, Legal aspects, Political aspects, Leases.

The Board of Supervisors of any county where the United States has authorized flood control improvements, including channel clearing, cut-offs, levees, and dams is authorized, in relation to such project, to assure the federal government that it will: (1) provide all necessary lands, easements, and rights-of-way; (2) hold the United States free from any damages due to construction; and (3) maintain and operate the works after completion. Additional powers of said counties include the right to: (1) levy and assess taxes; (2) exercise eminent domain; (3) accept conveyances of land; and (4) accept agreements from benefitted landowners to save the county harmless on account of said assurances given by the county. The board of supervisors of any county on the Mississippi in which a national park or cemetery is located may additionally levy a county-wide tax to supplement the construction and maintenance of the project. When the needed land is outside the county, the county is empowered to contribute to the cost of acquiring such land. All moneys paid to the state by the federal government for leases of flood control lands shall be apportioned to the counties in which such lands are located. (Schram-Florida)
W70-01153

SILVER BLUE LAKES APARTMENTS V SILVER BLUE LAKE HOME OWNERS ASS'N INC (UNREASONABLE USE OF ARTIFICIAL WATERBODY).
225 So2d 557-561 (3 DCA Fla 1969).

Descriptors: *Judicial decisions, *Legal aspects, *Florida, *Lakes, Riparian rights, Ownership of beds, Usufructuary right, Relative rights, Remedies, Riparian land, Surface waters.
Identifiers: *Man-made lakes, Injunctions (Prohibitory).

The owners of land underlying a man-made lake sought to enjoin an allegedly unreasonable use of the surface of the lake by tenants of an apartment complex bordering on the lake. The trial court issued the injunction to permanently enjoin the tenants from using the lake and restricting use to owners of the underlying land. The corporate owner of the apartments appealed, alleging that said injunction violated his constitutional rights. The district court of appeal affirmed saying that no rights of the owner were disturbed as he could still use the lake as an owner. The tenants, however, were not owners of underlying land. Therefore, they could be completely enjoined from using the lake because their use was unreasonable and made it impossible for the actual owners to exercise their right to use the lake. The corporate owner would

not be permitted to control the use of this man-made lake by multiplying its right of use by the number of tenants claiming under the corporation. (Darragh-Florida)
W70-01154

SURFACE RUNOFF AND FLOODWATER DIVERSION.

Va Code Ann secs 62.1-105, 62.1-106 (1968).

Descriptors: *Virginia, *Riparian rights, *Surface runoff, *Impounded water, Diversion, Water permits, Floodwater, Water levels, Prior appropriation, Priorities, Administration, Diversion structures, Water control, Water injury, Water law, Water rights, Water storage, Average flow, Damages, Legislation, Impoundments, Legal aspects.
Identifiers: Floodwater diversion.

A landowner may capture surface runoff waters on his land provided the capture does no damage to others. Upon approval, riparian owners may capture or impound water in watercourses which is over and above the average flow of the stream if: (1) the capture or storage will not damage others; (2) the riparian owner owns the land on which the water will be stored; (3) the riparian owner bears all costs of impounding the water; (4) a registered civil or agricultural engineer approves of the construction of the impounding facilities; and (5) the capture of water will not decrease the average flow in the watercourse. Upstream riparian owners have priority to the right to store floodwaters. (McDonough-Florida)
W70-01177

MILLS, DAMS, AND CERTAIN OTHER WORKS ON WATERCOURSES.

Va Code Ann secs 62.1-116, 62.1-119, 62.1-124 (1968).

Descriptors: *Virginia, *Mills, Mill dams, *Canals, Legislation, Public benefits, Public health, Dams, Dam construction, Barriers, Diversion structures, Fish barriers, Overflow, Navigation, Compensation, Riparian rights, Water law, Watercours (Legal), Canal construction, Administrative agencies, Water works, Relative rights.
Identifiers: *Obstructions to navigation.

A person owning a water mill useful to the public and desiring leave to erect a dam across or in the bordering watercourse, or to cut or enlarge a canal through lands above or below, or to raise a dam, or to construct a work on or through the lands of another to confine the watercourse, may apply to the circuit court of the county wherein such mill is located for such permission. Commissioners, appointed to decide such issue, must inquire whether any lands will be overflowed, navigation and the passage of fish will be obstructed, or the health of the neighbors will be annoyed by the stagnation of the waters or otherwise. They must also circumscribe the lands necessary for the canal, dam, or work not being more than one acre for a dam, nor more than one hundred feet in width for a canal, and must ascertain a just compensation. Any lands which will be adversely affected shall likewise be examined and compensation ascertained. These results must be set forth in a report. No person may by means of any such leave draw the water from any millpond of another or do anything in conflict with any vested right in any waterworks erected on such watercourse. (Schram-Florida)
W70-01178

IMPROVEMENT OF NAVIGABILITY OF STREAMS.

Va Code Ann secs 62.1-155 thru 62.1-158 (1968).

Descriptors: *Virginia, *Navigable rivers, *Navigation, *Channel improvement, Legislation, Easements, Right-of-way, Legal aspects, Permits, Pipelines, Transportation, Drainage systems, Bridges, Oysters, Shellfish, Clams, Local governments, Federal government, Water resources development, Utilities, River basin development, Dredging.

All cities situated on navigable streams may cooperate with the United States in the deepening, widening, and straightening of the channels thereof to improve navigability and in making provision for turning basins at terminals and mooring areas thereon. Such cities may assure the United States that they will: (1) furnish lands, easements, and rights-of-way and spoil or dredged material disposal areas; (2) furnish permits for ingress and egress to highways, construction of pipeline trestles across oyster and clamming grounds, and laying dredge pipelines across adjacent lands; (3) hold the United States free from damages; (4) relocate roads, bridges, waterfront structures, sewerage, water supply, and other utility facilities; (5) construct, maintain, expand, and operate terminal facilities; and (6) contribute funds for mooring areas adjacent to river terminals of such cities when necessary because of expansion of such terminal facilities. Such cities have the power to irrevocably bind themselves to do anything necessary to execute the above assurances. Claims for damages to oyster and clamming grounds may be asserted in the courts having jurisdiction in the county or city in which such damages occur. (Schram-Florida)
W70-01180

DUTIES OF DIRECTOR OF PUBLIC WORKS.
R I Gen Laws Ann secs 46-1-1, 46-1-2 (1956)

Descriptors: *Rhode Island, *Administrative agencies, *Harbors, *Supervisory control (Power), Tidal waters, Utilities, Public rights, Surveys, Navigation, State governments, State jurisdiction, Legislation, Water law, Legal aspects, Regulation, Administration.
Identifiers: Obstructions.

The Director of Public Works has control and supervisory power over all harbors and tidewaters in the state. The Director may order the removal of unauthorized obstructions and encroachments in harbors and tidewaters and may survey harbors and public waters to protect state interests. (McDonough-Florida)
W70-01182

CONSTRUCTION OF PORT FACILITIES.

R I Gen Laws Ann secs 46-5-1 thru 46-5-16 (1956), as amended, (Supp 1968).

Descriptors: *Rhode Island, *Harbors, *Port authorities, *Coastal engineering, Coastal structures, Navigation, Transportation, Eminent domain, Land tenure, Riparian rights, Piers, Channeling, Channels, Bulkheads, Landfills, Rates, Public benefits, Administrative agencies, State governments, Public lands, Legal aspects, Legislation, Leases, Docks, Basins, Condemnation.

The Department of Natural Resources may acquire by purchase, lease, or condemnation any real property, tide-flowed lands, plats, terms, easements, privileges, foreshore, riparian rights, littoral rights, and uplands as are necessary for public use. Title to such land shall vest in the state. Procedures are set forth herein for the taking of such lands. The Department may utilize such land for the construction of wharves, piers, bulkheads, slips, docks, basins, channels, and other port facilities, and may establish rates for the wharfage, cranage, and dockage of all vessels admitted thereto. The Department may also: (1) control and manage a portion of such facilities for public use; (2) lease the facilities; (3) establish regulations and penalties for the care of the acquired property; and (4) dispose of lands no longer needed. The administration of the division of fish and game in the Department of Agriculture and Conservation may expend the funds herein appropriated to establish and maintain yacht and boat moorings. Such moorings shall be available to the public without charge. (Marsee-Florida)
W70-01183

OBSTRUCTIONS TO NAVIGATION.
R I Gen Laws Ann secs 46-6-1 thru 46-6-16 (1956).

Descriptors: *Rhode Island, *Navigation, *Administrative agencies, *Regulation, Landfills, Tidal waters, Abatement, Cost allocation, Costs, Cost repayment, Cost transfer, Bays, Rivers, Boats, Piers, Bridges, Bridge construction, Oysters, Ships, Legislation, Federal government, State governments, Riparian rights.
Identifiers: *Shipwrecks, *Obstruction to navigation.

The Director of Public Works regulates the depositing of dirt and other substances into public tidewaters, and plans for the filling of tide flats or the construction of wharves, piers, bridges, or other structures over public tidewaters must be approved by the Department of Public Works. Unauthorized encroachments on tidewater constitute a public nuisance and may be abated. Special provisions are made for the protection from obstruction of certain specified watercourses. The Director of Public Works shall remove or have removed wrecked, sunken, or abandoned vessels and other obstructions from state tidewaters. The cost of such removal is distributed as herein provided. It is the duty of commissioners of wrecks and shipwrecked goods and of harbor masters to give immediate notice to the Department of Public Works of all shipwrecks and obstructions existing in tidewaters of their town or harbor. The Director may apply for federal reimbursement of removal expenses which might properly be paid thereby. Nothing herein shall impair the rights of riparian proprietors to construct wharves pursuant to law. (Marsee-Florida)
W70-01184

RHODE ISLAND PILOTAGE REGULATION.

R I Gen Laws Ann secs 46-9-1 thru 46-9-7 (1956).

Descriptors: *Rhode Island, *Navigation, *Admiralty, *Administrative agencies, Legislation, Boats, State governments, Leadership, Permits, Ships, Transportation, Legal aspects, Safety, Regulation.

It is the policy of Rhode Island to provide for safe navigation in state waters maintain a state pilotage system, and insure an adequate supply of well-qualified pilots. An independent State Pilotage Commission is created within the Department of Public Works. The duties of the Commission are set forth. Provision is also made governing: (1) which vessels are required to take pilots; (2) which vessels are exempt from this Act; (3) piloting without a license; and (4) qualifications for licensees. (Marsee-Florida)
W70-01186

THE ASWAN HIGH DAM,
Texas Univ., Austin.
For primary bibliographic entry see Field 06B.
W70-01201

FIELD EVALUATION OF SEEPAGE MEASUREMENT METHODS,
Idaho Univ., Moscow; and Agricultural Research Service, Kimberly, Idaho. Smake River Research Center.
C. E. Brockway, and R. V. Worstell.
Second Seepage Symposium, Proceedings, Phoenix, Arizona, Mar 25-27, 1968. Agricultural Research Service, Washington, DC, ARS 41-147, 1969. 7 p, 3 fig, 2 tab.

Descriptors: *Seepage, *Seepage losses, *Evaluation, *Canal seepage, *Field tests, Ponding, Pondng tests, Measurement, Reaches (Distance), daho, Costs, Field data.
dentifiers: Seepage meters, Inflow-outflow measurement, Minidoka Project (Idaho).

Experiments with ponding tests, seepage meters, nd inflow-outflow methods for measuring seepage rom canals were conducted in 1965-66 on the Minidoka Project in Idaho. The ponding test is the nost accurate but the most expensive. Using eepage meters for obtaining estimates is fast and economical; however, new types of meters capable f functioning in canals at operating depth should e developed and studied. Almost all available meers are capable of measuring seepage with easonable accuracy, but discretion must be used in he amount of confidence placed in average values letermined from meter tests. The procedure outined for estimating the number of meter tests equired can be used to judge the confidence to be laced in any group of tests. Inflow-outflow nethods are usually too expensive for short-duraion seepage measurements; however, a good installation does indicate seasonal changes in loss ates. Accuracy of inflow-outflow determinations is imited by flow-measuring devices, but for canals vith large seepage losses, inflow-outflow methods nay be the most expedient and sufficiently accurate. (USBR)
W70-01236

REVIEW OF METHODS FOR MEASURING AND PREDICTING SEEPAGE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Herman Bouwer, and Robert C. Rice.
Second Seepage Symposium, Proceedings, Phoenix, Arizona, Mar 25-27, 1968. Agricultural Research Service, Washington, DC, ARS 41-147, 1969. 6 p, 12 ref.

Descriptors: *Seepage, *Canal seepage, *Reviews, *Measurement, Ponding tests, Methodology, Forecasting, Seepage losses, Hydraulic conductivity, Water table, Ponding, Infiltration, Electric analogs, Instrumentation, Mathematical analysis, Hydraulic models.
Identifiers: Inflow-outflow measurement, Salt penetration method, Seepage meters.

Direct measurement of seepage can be obtained by inflow-outflow, ponding, seepage-meter, and salt-penetration techniques. Salt penetration is a recently developed tracer technique whereby seepage is determined from the rate of advance of dissolved salt in the bottom material. Advantages and disadvantages of the various techniques are discussed. Another approach for obtaining quantitative seepage information is to calculate the seepage rate from the hydraulic conductivity profile of the soil and the position of the groundwater table. Solutions can be obtained by mathematical analysis or by analog or model studies. Analyses by resistance network analog and the resulting dimensionless graphs for determining the seepage rate are discussed. In certain cases, knowing seepage in relation to time after water has entered a dry channel will be of interest. This is a problem of 2-dimensional infiltration, showing how simplified solutions can be obtained. (USBR)
W70-01238

4B. Groundwater Management

MOVEMENT OF DDT AND NITRATES DURING GROUND-WATER RECHARGE,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05B.
W70-00861

VALUATION OF A GROUNDWATER SUPPLY FOR MANAGEMENT AND DEVELOPMENT,
Nevada Univ., Reno. Desert Research Inst.
P. A. Domenico.
Tech Rep Ser H-W Hydrol Water Resources Publication No 3, Reno, July 1967. 46 p, 1 fig, 38 ref.

Descriptors: *Groundwater mining, *Water managment (Applied), *Mathematical models, *Optimization, *Resource development, Decision making, Water rights, Water levels, Economics, Monetary benefits.

Problems of groundwater management and development in terms of valuation of a resource or property that represented a source of future money receipts were discussed. A mathematical model was developed which gave both present worth of gains forthcoming from resources exploitation over a variable time period, and the remaining worth of a groundwater supply after it had been partially depleted. With the water level position selected as the denominator common to both the system and its economic worth, a course of exploitation was charted so that (1) present worth of future returns was maximized, and (2) water rights were protected to the extent that water levels were not lowered below the economic limit of pumping. The results enabled a conceptual valuation of (1) decision rules for efficiency in management, (2) optimal mining yield for specified conditions, and (3) the state of development of the resource at any time. (Thiuri-Cornell)
W70-00904

A CONJUNCTIVE OPERATION OF A SURFACE RESERVOIR AND A GROUNDWATER AQUIFER,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 02A.
W70-00906

BASIC CONCEPTS IN GROUND WATER LAW,
A. P. Black.
Am Water Wks Ass'n J, Vol 39, No 10, p 989-1001, Oct 1947. 13 p, 15 ref.

Descriptors: *Groundwater, *Legislation, *Water utilization, *Water allocation (Policy), Administration, Competing uses, Consumptive use, Domestic water, Beneficial use, Reasonable use, Riparian rights, Percolating water, Withdrawal, Priorities, Well regulation, Administrative agencies, Water rights, Water law, Prior appropriation, Preferences (Water rights).

The growing need for legislation to deal adequately with the use of ground water supplies is examined. The author discusses the limitations and advantages of the three major rules which are the basis of most legislation on ground water rights: the common-law doctrine, the American rule of reasonable use, and the doctrine of prior appropriation. The author suggests the following basic concepts which should be incorporated into legislation for the control of ground water. Beneficial use should be the basis, the measure, and the limit to the use of water. The program should be administered on the state level by an agency with the power, subject to judicial review, to determine water rights. Vested rights to the use of water should be recognized to the greatest extent consistent with existing conditions in the area. Use of water for domestic purposes should be specifically exempted from the provisions of the statute. Reasonable limits, within which a later appropriation could rightfully lower the head of water, should be included. Finally, the right of eminent domain should assure towns and cities water supplies adequate for present and future use. (Gabrielson-Florida)
W70-00914

RECORDS OF SELECTED WELLS AND SPRINGS IN THE RULISON PROJECT AREA, GARFIELD AND MESA COUNTIES, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07C.
W70-00987

GROUNDWATER IN SANTA BARBARA COUNTY, CALIFORNIA, SPRING 1967 TO SPRING 1968,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07C.
W70-00989

VILLAGE WATER SUPPLY INVESTIGATION, TERRITORY OF PAPUA AND NEW GUINEA,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
For primary bibliographic entry see Field 03B.
W70-00991

A GROUNDWATER QUALITY SUMMARY FOR ALASKA,
Alaska Univ., College. Inst. of Water Resources.
Steve W. Kim, Phillip R. Johnson, and R. Sage Murphy.
Available from the Clearinghouse as PB-187 683, for $3.00 in paper copy, $0.65 in microfiche. Project Completion Report, Alaskan Institute of Water Resources, Report No IWR-10, 1969. 32 p, 13 tab, 5 fig, 4 ref. OWRR Proj A-022-ALAS.

Descriptors: *Groundwater, *Water quality, Arctic, Cold regions, Water distribution.
Identifiers: *Alaskan groundwater quality.

This report is a termination report based upon data obtained from various governmental agencies operating in the state of Alaska. Groundwater quality data is presented for 465 analyses at 123 remote Alaskan locations. Data presented includes location, date sampled, and the following chemical analyses: iron, chloride, total dissolved solids, hardness, alkalinity, and color.
W70-01087

BASIC WATER USE DOCTRINES AND STATE WATER CONTROL AGENCIES.
For primary bibliographic entry see Field 04A.
W70-01131

WATER RESOURCES.

Miss Code Ann secs 5956-31 thru 5956-34, 5956-36 thru 5956-39 (Supp 1968).

Descriptors: *Mississippi, *Water resources, *Well regulations, *Drilling, Drilling equipment, Well permits, Wells, Permits, Water law, Administrative agencies, Adjudication procedures, Regulation, Inspection, Control, On-site investigations, Legislation, Legal aspects.

Every person desiring to engage in the business of drilling wells for water shall file an application with the State Board of Water Commissioners for a drilling license. This shall not apply to persons drilling wells on their own land. Such licenses must be renewed yearly. The Board of Water Commissioners shall be empowered to make rules and regulations and give examinations. When the Board believes there has been a violation of its rules, it shall give notice of the desired remedial action or notice of a hearing. If the offender desires he may request a hearing. The grounds for revocation are specified in this statute. The Board is empowered to appoint an advisory board to make recommendations for the regulation and control of drillers. Any person who engages in well drilling in violation of this act shall be guilty of a misdemeanor. (Darragh-Florida)
W70-01156

PATTERNS OF WATER USE IN THE ARIZONA ECONOMY,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06D.
W70-01202

4C. Effects on Water of Man's Non-Water Activities

CALCULATION OF WATER POLLUTION BY SURFACE RUNOFF,
For primary bibliographic entry see Field 05B.
W70-01026

CIVIL LAW PROPERTY--ENCROACHMENTS ON RIVER BANKS BY RIPARIAN OWNERS,
Gillis W. Long.
La L Rev, Vol 9, No 4, p 542-545, May 1949. 4 p, 16 ref.

Descriptors: *Louisiana, *Banks, *Public rights, *Land tenure, Judicial decisions, Legislation, Riparian rights, Relative rights, Riparian land, Civil law, Structures, Buildings, Water law, Cities, Navigable waters.

And elementary legal principle is that the banks of navigable streams are public. The Louisiana courts have traditionally been uniform in sustaining injunctions preventing erection and ordering removal of permanent installations on property subject to this public servitude. Early Louisiana law provided that it was sufficient to warrant removal of a structure if the public use was merely obstructed or 'interrupted.' Early cases provided that the owners of riparian land could not use the bank as private property, and encroachments could be removed at the instance of municipal officers or by individuals living within the municipal corporation. Article 862 of the Louisiana Civil Code allows minor encroachments upon banks and has occasionally been invoked when the interference with the bank was negligible or the cost of removal was prohibitive. In Town of Madisonville v Dendinger, 38 So 2d 252 (La 1948), the court seems to have altered the basis for removal of structures from the more restrictive 'obstruct or embarrass the use' test to allowing the structure to remain under Article 862, unless it 'prevents the use' of the bank by the public completely. The court felt the plaintiff had not made out a case of prevention of use, and the decision marks a permissive trend which may be explained by a decline in water transporation and a rise in the need of industry to utilize bank space. (Harris-Florida)
W70-01135

MILLS, DAMS, AND CERTAIN OTHER WORKS ON WATERCOURSES.
For primary bibliographic entry see Field 04A.
W70-01178

4D. Watershed Protection

ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION, 1963-65, UNITED STATES AND CANADA.
Engineering-Science, Inc., Los Altos, Calif.
For primary bibliographic entry see Field 02J.
W70-00837

THE ENVIRONMENT--AND WHAT TO DO ABOUT IT,
Atomic Energy Commission, Washington, D.C.
Glenn T. Seaborg.
Nucl News, Vol 12, No 7, p 35-43, July 1969. 8p.

Descriptors: *Environment, *Ecology, *Pollution abatement, *Balance of nature, *Air pollution, *Water pollution, Environmental effects, Environmental engineering, Environmental sanitation, Fish and wildlife, Natural resources, Man, Conservation, Technology, Water pollution control, Water pollution effects, Waste disposal, Thermal pollution.
Identifiers: Air pollution control, Pollution control.

Environment has become an emotionally charged word on a par with such phrases as 'student revolts' or 'Raquel Welch,' depending upon which emotion you want charged. The facts and projections on environmental prospect are frightening and the challenge must be met, but we also suffer from misunderstanding, and need a rational outlook to clarify man's relationship with the environment. Talking of the balance of nature is quite fashionable today, implying that with a hands-off policy, natural process would somehow adjust all to everyone's benefit; this is not true. Nature pollutes and destroys; history records many earthquakes, volcanic eruptions, floods, and plagues. Modern man cannot be totally objective when his own survival is at stake; he must occasionally do some tampering with the balance of nature to favor himself. Man-made environment problems are a result of population growth, excessive and unplanned use of technology, neglect and lack of self-imposed standards, and inability to anticipate detrimental effects of a technology. The problems will not be solved by turning off a faucet marked technology. The difficult task ahead will take new thinking, cooperation among many people, and choosing between new alternatives. (USBR)
W70-01106

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

GEOLOGY, PETROLEUM DEVELOPMENT, AND SEISMICITY OF THE SANTA BARBARA CHANNEL REGION, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-00836

APPLICATION OF PYROLYTIC GAS CHROMATOGRAPHY TO NATURAL WATERS,
Rocketdyne, Canoga Park, Calif. Research Div.
K. H. Nelson, and I. Lysyj.
Water Research, Vol 3, No 5, p 357-365, May 1969. 9 p, 7 fig, 20 ref. Office of Saline Water Contract 14-01-0001-965.

Descriptors: *Pollutant identification, *Gas chromatography, *Analytical techniques, *Organic compounds, Organic matter, Water quality, Streams, Reservoirs, Ecological distribution, Water properties, Water chemistry.
Identifiers: *Pyrolitic gas chromatography.

A modified pyrographic technique for characterization of nonvolatile organics in aqueous solutions is described. This method was developed from a pyrolytic procedure for the determination of the total organic content of natural waters. In the modified technique, pyrolysis of the organic matter without prior separation from the water is followed by gas chromatographic separation and flame ionization detection of the produced organic fragments. The organic composition of the samples then can be calculated from the pyrolytic spectrums. The method was applied to natural waters from several localities in the western part of the United States. Differences were observed in the number and intensities of peaks on the pyrograms. Investigations are underway to develop, improve, and adapt the technique for determination of organic matter in water, both particulate and dissolved, and to determine the role of organic matter in stream ecology. (Carstea-USGS)
W70-00847

A RAPID FOR MEASURING THE ACUTE TOXICITY OF DISSOLVED MATERIALS TO MARINE FISHES,
National Inst. for Water Research, Congella (South Africa). Regional Lab.
J. A. Ballard, and W. D. Oliff.
Water Research, Vol 3, No 5, p 313-333, May 1969. 21 p, 12 fig, 13 tab, 7 ref.

Descriptors: *Analytical techniques, *Toxicity, *Pollutants, *Dissolved oxygen, Poisons, Phenols, Fish, Lethal limit, Water temperature, Dissolved oxygen analyzers.
Identifiers: *Acute toxicity measurement, *Marine fish poisoning, Fish diseases.

A method is given for measuring the toxicity level of dissolved poisonous substances to fish. This rapid residual oxygen method is compared with the routine 24 or 48 hr test. The residual oxygen concentration at the time of fish death is measured either with a galvanic cell oxygen analyser probe or by titration using the oxide modification of the Winckler method. Effects of varying the densities per unit volume of test fishes, water temperature, and size of the fish were examined. A high fish density per unit volume reduces the exposure time and as a general rule toxicity is detected at higher concentrations of poison. Mercuric chloride showed no difference between the toxicity threshold at 15 deg C, 20 deg C and 25 deg C. In contrast, at 15 deg C, the toxicity for phenol is lowered to a concentration that is only one third that measured at 25 deg C. The grouping of fish according to size resulted in a reduced coefficient of variation. The test is simple and results are available in 8 hr. (Carstea-USGS)
W70-00849

PHYSICAL AND BIOCHEMICAL ASPECTS OF BOD KINETICS,
Technische Hochschule, Karlsruhe (West Germany). Lehrgebiet fur Ingieurbiologie.
For primary bibliographic entry see Field 05C.
W70-01024

STATISTICAL CHARACTERIZATION OF MIXTURES OF HYDROCARBONS,
J. Ruchti, and H. R. Krahenbuhl.
Water Research, Vol 2, No 1, p 26, Jan 1968.

Descriptors: *Pollutant identification, *Gas chromatography, *Methodology, Surface waters, Fuels, Oil, Pollutants, Statistical methods, Soils, Sewerage.
Identifiers: Hydrocarbon mixtures.

The paper describes a gas chromatography method used to identify the hydrocarbons (oils and fuels) in surface water, sewerage, and soils. The gas chromatograms for various commerical oils and fuels which were characterized by the average retention times are presented. The sensitivity of the method and its practical applications in identifying and measuring various pollutants of hydrocarbon nature are discussed. (Carstea-USGS)
W70-01025

THE CLASSIFICATION OF WATER QUALITY FROM THE BIOLOGICAL POINT OF VIEW,
Wolf Von Tumpling.
Water Research, Vol 2, No 1, p 40-42, Jan 1968. 1 fig, 1 tab, 10 ref.

Descriptors: *Bioindicators, *Water quality control, *Water quality, Biological properties, Watershed management, Dissolved oxygen, Biochemical oxygen demand, Statistical methods, Physical properties, Water chemistry.
Identifiers: *Water quality classification, Biological factors.

Statistical methods were used to correlate several biological parameters of water quality and to determine the probability of exceeding limiting values. A biological classification was selected because biological parameters have higher stability than chemical and physical parameters. The 4 classes of water quality are characterized by dissolved oxygen, oxygen saturation deficit, 2-day BOD, 5-day BOD, and ammonium ions. (Carstea-USGS)
W70-01029

THE USE OF A DIGITAL SIMULATION SYSTEM FOR THE MODELING AND PREDICTION OF WATER QUALITY,
R. T. Jaske.
Water Research, Vol 2, No 1, p 37-40, Jan 1968. 3 fig, 5 ref.

Descriptors: *Model studies, *Simulation analysis, *Tracers, *Thermal pollution, *Water pollution control, Water quality control, Digital computers, Dispersion, Streamflow, Dissolved oxygen, Reservoir storage, Nuclear reactors, Radioactive wastes, Density currents, Columbia River.
Identifiers: *Digital simulation, Water quality prediction.

Cooler water was released from the lower levels of Lake Roosevelt to reduce the water temperature of the Columbia River in the vicinity of Hanford nuclear plant. Manual computation of water quality became impractical because additional impoundments produced changes in circulation patterns. Therefore, a digital computer simulation system was developed using actual stream measurements for comparison. The computer program was modified to include stochastic consideration of density currents and the resulting one dimensional model had relatively good linear dispersion characteristics. Weather data were taken from Hanford station which was considered to represent a regional pattern. Simulation of conservative and nonconservative substances was included in the system. Sodium dichromate and radioactive tracers were used to simulate downstream concentrations. The model can be easily adapted to any regional system or any specific stream, and was used to study the potential thermal modification of Illinois rivers. Modeling of dissolved oxygen and reservoir storage are possible by adaption of the original program. (Carstea-USGS)
W70-01030

THE PREDICTION OF THE DISTRIBUTION OF DISSOLVED OXYGEN IN RIVERS,
For primary bibliographic entry see Field 05B.
W70-01033

APPROACH TO DETERMINE THE MINIMUM ALLOWABLE FLOW IN THE TISZA RIVER, HUNGARY,
For primary bibliographic entry see Field 05G.
W70-01035

BACTERIAL AND PROTOZOAN INDICATORS OF WATER POLLUTION - STATISTICAL AND EXPERIMENTAL APPROACH,
V. Straskavoba, and M. Legner.
Water Research, Vol 2, No 1, p 8-12, Jan 1968. 7 fig, 1 tab, 7 ref.

Descriptors: *Water pollution, *Bioindicators, Protozoa, Bacteria, Biochemical oxygen demand, Bioassay, Statistical methods, Running waters, Stagnant water, Aquatic microorganisms.
Identifiers: Water pollution bioindicators.

Bacteriological methods were used to establish quantitative relationships between organisms and water pollution in running and stagnant waters. The number of bacteria estimated by membrane filter methods showed a linear relationship with the biochemical oxygen demand. There was no difference in slope of the curves between running and stagnant waters. The agar method also showed linear relationship between number of bacteria and biochemical oxygen demand for running water and sewage samples. At the same biochemical oxygen demand values, the numbers of bacteria in samples from stagnant water was lower than in those from running water. The experimental data showed good agreement with those obtained in other counties by using slightly different methods. A direct relationship was found between the prediction of ciliates and the organic load (water pollution). (Carstea-USGS)
W70-01036

THE WATER QUALITY PROTECTION PLAN. EFFICIENT MEANS TO ASSURE RATIONAL USE IN HYDROGRAPHIC BASINS (FRENCH),
S. Antonius.
Water Research, Vol 2, No 1, p 4-6, Jan 1968.

Descriptors: *Water quality control, *Water pollution control, *Water resources development, Water supply, Hydrography, Stream improvement, Hydrologic data, River basin development, Watershed management, Water management (Applied), Mathematical models, Model studies.
Identifiers: *Water quality model, Hydrographic basin.

A water quality protection plan includes collection of fundamental data such as water use, sources of pollution, hydrological, physical and chemical characteristics of the rivers in the basin and interpretation of collected data using a mathematical model, to establish the corrective scheme. The nature and sources of water pollution are correlated with water users and water sources. This calculation will permit the evaluation of water quality properties (BOD, suspended material, toxic substances and temperature). The water manager will be able to control the water pollution and take necessary steps to purify the polluted water. It is recommended that the water quality model should be periodically revised as to reflect the economic and social changes in the basin. (Carstea-USGS)
W70-01038

SAMPLING AND ANALYSIS OF WASTE WATER FROM INDIVIDUAL HOMES (TASK 2),
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01050

USE OF A SELECTIVE ION ELECTRODE FOR DETERMINATION OF NITRATE IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
J. M. Bremner, L. G. Bundy, and A. S. Agarwal.
Analytical Letters, Vol 1, No 13, p 837-844, 1968. 4 tab, 6 ref.

Descriptors: *Chemical analysis, *Nitrates, *Soil analysis, Nitrogen compounds, Soil chemistry, Instrumentation, Ions, Electrodes, Hydrogen ion concentration, Soil texture, Organic matter, Sulfates, Phosphates, Chlorides, Nitrites, Pollutant identification.
Identifiers: *Electrodes (Selective ion), Orion nitrate electrode, Nitrate-nitrogen, Temperature effects, Nutrient sources.

A method for precise and accurate measurement of nitrate concentration in soil extracts and soil-water suspensions with the Orion nitrate electrode is described. Techniques for preparation of soil suspensions which produced maximal nitrate-nitrogen values in all soils studies are delineated. Recoveries of known amounts of added nitrate were quantitative with soil samples which varied widely in pH, texture, and content of organic matter. No effects of pH and temperature were found in pH ranges of 5 to 8 and temperature ranges from 15-30 deg C. Use of calcium chloride (0.01 Molar) in place of distilled water in soil suspensions greatly reduced or eliminated interference by other anions, principally sulfate, dihydrogen phosphate, chloride, and nitrite, but reduced the sensitivity of the method. (Byrnes-Wisconsin)
W70-01075

5B. Sources of Pollution

GEOLOGY, PETROLEUM DEVELOPMENT, AND SEISMICITY OF THE SANTA BARBARA CHANNEL REGION, CALIFORNIA,
Geological Survey, Washington, D.C.
J. G. Vedder, R. F. Yerkes, T. H. McCulloh, R. M. Hamilton, and H. C. Wagner.
Geol Surv Prof Pap 679, 1969. 77 p, 5 fig, 3 plate, 77 ref, 5 append.

Descriptors: *Oil fields, *Geology, *Water pollution sources, Oil reservoirs, Stratigraphy, Oily water, Drilling, Geologic investigations, Structural geology, Faults (Geology), Land subsidence, Rock mechanics, Seismology.
Identifiers: Santa Barbara Channel Oil Field (Calif).

During normal development of an oil pool on the Rincon structural trend, about 6 1/2 miles southeast of Santa Barbara, California, a gas blowout occurred on Jan. 28, 1969. Until Feb. 7, when the well was killed by cementing, uncontrolled flow led to local oil pollution of the sea surface. Reservoir damage during this period caused moderate and steady oil seepage. This seepage, estimated to be 30 barrels per day from March through June 1969, was reduced by early September to less than 10 barrels per day by drilling and grouting. Information is presented to help provide abetter understanding of the structural geologic, stratigraphic, and seismic framework of the Channel region and of the circumstances relating to the oil seepage. In 1968, the channel area produced 22.9 million barrels of oil, about 6% of California's production. Cumulative oil production at the end of 1968 was about 1.1 billion barrels, or about 7 1/2% of California's total production. Dry gas production in 1968 was about 12% of the State production. The large production of the Rincon trend fields is attributable to thick, oil-saturated sections and relatively high porosities and permeabilities. The Santa Barbara Channel region is seismically active: since 1900 it has experienced two earthquakes of magnitude 6, and in 1812 it was the site of a shock that may have attained magnitude 7. (Knapp-USGS)
W70-00836

MOVEMENT OF DDT AND NITRATES DURING GROUND-WATER RECHARGE,
Robert S. Kerr Water Research Center, Ada, Okla.
Marion R. Scalf, William J. Dunlap, Leslie G. McMillion, and Jack W. Keeley.
Water Resources Res, Vol 5, No 5, p 1041-1051, Oct 1969. 12 p, 10 fig, 1 tab, 19 ref.

Descriptors: *Path of pollutants, *Groundwater movement, *DDT, *Nitrates, *Tracking techniques, Tracers, Water wells, Pumping, Recharge, Discharge (Water), Adsorption, Dispersion.
Identifiers: Aquifer tests, Pumping tests, Ogallala aquifer.

The Robert S. Kerr Water Research Center, U. S. Department of the Interior, and Southwestern Great Plains Research Center, U. S. Department of Agriculture, recently cooperated in a field investigation of the fate of DDT and nitrates when artificially recharged into the Ogallala aquifer. The USDA provided recharge and observation wells and hydraulic equipment for injecting 350 gpm of water with known concentrations of radioactive tracer, DDT, and nitrates. Following 10 days of recharge, the recharge well was pumped for 12 days at 500 gpm. During recharge the nitrates moved to the observation wells essentially at the same rate as the recharge water, and the DDT was absorbed to the aquifer material very near the recharge well. During the pumping phase, 94% of both the recharge water and the nitrates was recovered. The concentration of DDT in the pumped water was about 16 times the recharged concentration at initiation of pumping but dropped below recharge concentration within one hour. Apparently a major portion of the DDT introduced during recharge was not recovered during pumping but remained in the aquifer. (Knapp-USGS)
W70-00861

THE USE OF THE FUNDAMENTAL STUDIES OF BIOLOGICAL PURIFICATION ON THE PURIFICATION OF POLLUTED WATERS DERIVED FROM PRODUCTION OF 'KHEMLON' (SLOVAKIAN),
For primary bibliographic entry see Field 05D.
W70-00879

SOME THERMAL CHARACTERISTICS OF TWO RIVERS IN THE PENNINE AREA OF NORTHERN ENGLAND,
Durham Univ. (England). Dept. of Geography.
K. Smith.
Journal of Hydrology, Vol 6, No 4, p 405-416, Aug 1968. 6 fig, 4 tab, 18 ref.

Descriptors: *Air temperature, *Water temperature, Air-water interfaces, Thermal stratification.
Identifiers: Air-water temperature relationship, Northern England.

This paper examines water temperature data obtained over a 4 year period (1958-1961) for two adjacent rivers in northern England. The thermal regime is compared at upstream and downstream sites on each river, and the relationships between river water and air temperatures are also discussed. It is emphasized that a satisfactory explanation of the variations revealed is only possible through a consideration of both climatological and hydrological factors. (Guerrero-Vanderbilt)
W70-00881

PHYSICAL MODELING OF REGIME OF BODIES OF WATER TO STUDY THEIR SANITATION CONDITION (IN RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
V. A. Znamenskyi.
Nauchnyie doklady po voprosam samootshchishchena vodoyemov i smeshchenia stochnych vod, p 188-199, Tall Pol Inst, Tallinn ESSR, 1965.

Descriptors: *Model studies, *Mathematical models, Hydraulical models, Hydraulic similitude, Turbulence, Water quality, Reynolds number, Froude number, Waves, Thermal properties, Tidal effects.

The most effective way of solving the problem of either hydrodynamic behavior of bodies of water or dilution processes in them is a combination of theoretical computations with physical modeling. This paper deals mainly with the mathematical modeling of hydrodynamic behavior of estuaries and takes into account the effects of wind and tidal wave propagation. The difference of discharges coming into the body of water and going out is expressed as delta Q= Sxu, where S is the surface area and u is the velocity of change in depth. According to measurements in the Neva estuary near Leningrad, this discharge difference can be 10-20 times higher than the inflow rate. The influence of temperature and thus the density distribution is also discussed. The space modeling which is described must take into account the gravity, inertial and viscosity forces. Dye and salt were used as a representation of pollution in these space models. It is concluded that the use of space models yields solutions to many problems of water quality behavior in the receiving waters. (Novotny-Vanderbilt)
W70-00885

MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
General Electric Co., Philadelphia; and Federal Water Pollution Control Administration, Philadelphia, Pa.
For primary bibliographic entry see Field 05C.
W70-00896

THE RELATION OF ION MOVEMENT TO FINE PARTICLE DISPLACEMENT IN A SAND BED,
Georgia Inst. of Tech., Atlanta.
Jerry B. F. Champlin.
Available from the Clearinghouse as PB-187 521, $3.00 in paper copy, $0.65 in microfiche. Water Resources Center, Georgia Institute of Technology, WRC-0369, July 1969. 22 p. OWRR Proj A-002-GA.

Descriptors: *Ion transport, *Radioactive tracers, *Ion movement, *Ion adsorption, *Porous media, *Sand filters, Radioisotopes, Ion exchange, Trace elements, Aquifers, Radioactivity, Radioactive waste disposal, Water purification, Water quality.
Identifiers: Scandium, Rubidium, Lanthanum.

Determination of the fundamental mechanisms by which trace metals and organic compounds are fixed or immobilized by the soil and sediments of the earth from water moving through aquifers is the research objective. Dilute water suspensions (model wastes) were passed through packed sands (model soils), forming a horizontal simulated aquifer 2 meters long, 1 meter wide and 1/4 meter thick. Retention of radioactivity added to water, to suspended clay, and to suspended bacteria by the sand bed was investigated, using radioisotopes of rubidium, lanthanum and scandium. In general, some of the radioactivity originally in solution transferred to fines derived from the sand bed and passed through into the effluent. A significant portion of the radioactivity initially placed on the clay also passed through the sand bed. None of the radioactivity added to the bacteria passed through the sand bed into the effluent. The research established that significant movement of ionic matter through porous beds of soils can take place in the form of dilute suspensions at low salt concentrations; and that direct transfer to free ions through packed beds at low dissolved salt concentrations is unlikely. (Conway-Georgia Tech)
W70-00909

TEMPORAL, HORIZONTAL AND VERTICAL VARIABILITY OF WATER CHEMISTRY IN UNSATURATED ZONE OF FINE-GRAINED SOILS,
Idaho Univ., Moscow. Water Resources Research Inst.
Roy E. Williams.
Available from the Clearinghouse as PB 187 523, $3.00 in paper copy, $0.65 in microfiche. Research Technical Completion Report, Idaho Water Resouces Research Institute. June 1969. 31 p. 3 tab, 3 fig, 3 ref. OWRR Proj A-021-IDA.

Descriptors: Soil chemistry, Soil analysis, Soil chemical properties, *Soil moisture meter, *Infiltration, *Ion transport, *Water pollution sources.

A method was developed for extracting water samples from unsaturated soils under low moisture content and concomitant high tension. A sample collection cell was constructed by enclosing a hydrophylic, cross-linked, dextran xerogel in seamless, dialyzer tubing with opening diameters of 48 angstroms. When the cell is placed in contact with a soil, water and its dissolved ions move through the membrane and into the hydrophylic substance. Because the ion exchange capacity of the xerogel is negligible, the water and ions can be replaced by distilled, deionized water and the effluent analyzed. However, chemical analysis of the effluent has revealed that results are not reproducible and that unreasonably high concentrations of some ions often result. Combination tracer and infiltration tests have demonstrated that water moves through the loess soils of northern Idaho via discontinuities as well as through intergranular pore spaces. Whether the discontinuities are operative in the infiltration process depends on the surface condition and on the application rate. These must permit a saturated layer to form above the discontinuities before they can begin to water preferentially. (Corey-University of Idaho)
W70-00911

MEASUREMENT OF COLUMBIA RIVER FLOW TIME FROM HANFORD REACTORS TO ASTORIA, OREGON-SUMMER 1966,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 02E.
W70-01002

CALCULATION OF WATER POLLUTION BY SURFACE RUNOFF,
N. A. Pravoshinsky, and P. D. Gatillo.
Water Research, Vol 2, No 1, p 24-26 Jan 1968.

Descriptors: *Water pollution sources, *Water quality, *Surface runoff, *Water pollution control, Pollutants, Water properties, Oil, Snowmelt, Sewage, Biochemical oxygen demand, Statistical methods, Suspended load, Chlorides, Coliforms.
Identifiers: *Urban runoff, *USSR, Minsk, Soligorsk, Street washings.

Water pollution by surface runoff was studied (1964) in two districts of Minsk and in 1966 from the Soligorsk area. The main index of pollution was the 5-day BOD. Suspended solids, chlorides, oil products and coliform counts were also determined. Water from asphalt surfaces was more polluted than the water from unpaved areas. The amount of pollutants in runoff water was about 13% of the amount measured in raw domestic sewage. Statistically analyzed data show a relationship between water quality and stream flow. The stream character, duration of the preceeding dry weather period, seasonal variation, and the type of surface were also condensed in the interpretation and application of data. The study are was divided into sections based primarily on hydraulic properties and the way pollutants reach the water course. The concentration of pollutants, their rate of purification, total BOD, oxygen concentration, amount of suspended solids and number of bacteria revealed differences between rivers and ponds. (Carstea-USGS)
W70-01026

STUDIES ON NATURAL FACTORS AFFECTING PHOSPHATE ABSORPTION AND ITS UTILIZATION BY ALGAE,
For primary bibliographic entry see Field 05C.
W70-01031

THE PREDICTION OF THE DISTRIBUTION OF DISSOLVED OXYGEN IN RIVERS,
M. Owens, and G. Knowles.
Water Research, Vol 2, No 1, p 20-21, Jan 1968. 2 p.

Descriptors: *Dissolved oxygen, *Mathematical models, *Mixing, *Diffusion, *Tracers, Analytical techniques, Aeration, Water management (Applied), Rivers, Water temperature, Solar radiation, Streamflow, Aquatic plants.
Identifiers: Dissolved oxygen prediction, River management.

A simple mathematical model is given to be used for predicting the changes in oxygen content in rivers. The basic processes responsible for changes in oxygen content are matematically expressed using river flow, surface area between two stations and the oxygen concentrations at the stations. A series of empirical relations was developed to describe the influence of environmental conditions upon the dissolved oxygen content. Water temperature, intensity of solar radiation and average biomass of aquatic plants were used in predicting the oxygen content. Calculated and observed dissolved oxygen distributions were in fairly good agreement in unpolluted streams. The mixing coefficients derived by tracer techniques were introduced in the refined mathematical model. The potential applications of the model in water management is also discussed in the paper. (Carstea-USGS)
W70-01033

THE WATER QUALITY PROTECTION PLAN. EFFICIENT MEANS TO ASSURE RATIONAL USE IN HYDROGRAPHIC BASINS (FRENCH),
For primary bibliographic entry see Field 05A.
W70-01038

STUDIES ON ALGAL SUBSTANCES IN THE SEA. II. THE FORMATION OF GELBSTOFF (HUMIC MATERIAL) BY EXUDATES OF PHAEOPHYTA,
Norwegian Inst. of Seaweed Research, Trondheim.
John McN Sieburth, and Arne Jensen.
J Experimental Marine Biology and Ecology, Vol 3, p 275-289, 1969. 7 fig, 4 tab, 20 ref.

Descriptors: *Oceans, *Marine algae, *Seawater, *Humic acids, *Phaeophyta, *Exudation, Ecology, Phenols, Carbohydrates, Chromatography, Dialysis, Bogs, Sulphates, Pulp and paper industry, Proteins, Ultraviolet radiation, Fluorescence, Larvae, Pigments, Salinity, Hydrogen ion concentration, Temperature, Pulp wastes, Streams, Effluents, Littoral, Spectrophotometry, Water pollution sources.
Identifiers: *Gelbstoff, *Algal substances, *Fucus vesciculosus, Norway, Laminaria hyperborea, Ascophyllum nodosum, Fractionation, Pleuronectes platessa, Olisthodiscus, Trondheim (Norway), Blue fluorescing material, Sublittoral zone, Nylon column technique.

Preliminary observations on exudation from Fucus vesiculosus confirm the importance of this process in ecology of inshore waters. Algae, maintained in the laboratory for 24 hours, exuded 500-800 milligrams of phenolic, and 1.0-1.5 grams of carbohydrate materials per kilogram dry weight of Fucus. Qualitative studies on standing exudates from three important Norwegian seaweeds show that exudates form humic substances (Gelbstoff) inseparable from that present in seawater. Observations based on paper chromatography, dialysis, Sephadex fractionation and recombination of fractions led to elaboration of a hypothesis for Gelbstoff formation from algal exudates. Brown seaweeds exude a few simple, potentially phenolic precursors; these form polyphenols in alkaline seawater which rapidly react with proteinaceous and carbohydrate material, the resulting complexes constituting a considerable part of marine Gelbstoff. The larger molecular complexes of Gelbstoff are continually precipitating to form organic aggregates. Similar transformations of phenolic precursors to soluble Gelbstoff complexes and the subsequent formation of colored precipitates take place in bog water and in sulphate effluents. Common mechanisms, involving simple phenols, proteinaceous, and carbohydrate matter, may result in formation of terrestrial and marine Gelbstoff. (Jones-Wisconsin)
W70-01072

STUDIES ON ALGAL SUBSTANCES IN THE SEA. III. THE PRODUCTION OF EXTRACELLULAR ORGANIC MATTER BY LITTORAL MARINE ALGAE,
Rhode Island Univ., Kingston. Narragansett Marine Lab.
John McN Sieburth.
J Experimental Marine Biology and Ecology, Vol 3, p 290-309, 1969. 1 fig, 18 tab, 26 ref.

Descriptors: *Oceans, *Marine algae, *Littoral, *Organic matter, Exudation, Tides, Photosynthesis, Solar radiation, Salinity, Rainfall, Temperature, Colorimetry, Carbohydrates, Phenols, Nitrogen, Respiration, Carbon, Primary productivity, Oxygen, Metabolism, Wind velocity, Humidity, Bacteria, Hydrogen ion concentration, Sulfates, Respiration, Food chains.
Identifiers: *Algal substances, *Extracellular, Fucus vesiculosus, Chondrus crispus, Ascophyllum nodosum, Laminaria digitata, Laminaria agardhii, Desiccation, Immersion, Narragansett Marine Laboratory (Rhode Island), Dilution rate, Fruiting bodies, Ulva lactuca var latissima, Polysiphonia harveyi, Epiphytic bacteria, Sublittoral, Yellow material, Dumontia incrassata, Emersion.

Sunlit and darkened Fucus vesiculosus accumulate no dissolved organic matter in closed systems, in which problem of bacterial growth was not entirely overcome. Open systems, with seawater dilutions, consistently accumulated appreciable quantities of extracellular organic carbon. Exudation in Fucus, coupled directly with photosynthesis, increased with solar radiation. Two Laminaria produced exudation in the dark. Reducing salinity of seawater apparently diminished organic matter exudation rate by Fucus. Organic carbon is lost upon re-immersion of dissicated Fucus in seawater. Algal clumps on exposed rocks lost some 39 milligrams carbon/100 grams. Light natural rainfall more effectively extracts organic carbon than artificial rainfall. Nature of exudates, determined by colorometric assay, revealed that carbohydrates are most abundant, followed by equal amounts of nitrogenuous and polyphenolic material. During spring conditions, Fucus exudes approximately 30% of total or 40% of net carbon fixed daily. Since biomass of carbon in Fucus beds can exceed 1000 grams/square meter and algae minimally fix 6.5 grams/square meter/day, Fucus exudation of organic matter equal 5-7 grams carbon/square meter/day. (Jones-Wisconsin)
W70-01073

STUDIES ON ALGAL SUBSTANCES IN THE SEA. I. GELBSTOFF (HUMIC MATERIAL) IN TERRESTRIAL AND MARINE WATERS,
Norwegian Inst. of Seaweed Research, Trondheim.
John McN Sieburth, and Arne Jensen.
J Experimental Marine Biology and Ecology, Vol 2, p 174-189, 1968. 8 fig, 1 tab, 24 ref.

Descriptors: *Oceans, *Marine algae, *Seawater, *Fresh water, *Humic acids, *Color, Rivers, Bogs, Phenols, Pigments, Organic matter, Biomass, Benthic flora, Phaeophyta, Polar regions, Spectrophotometry, Chromatography, Hydrogen ion concentration, Fluorescence, Carbohydrates, Temperature, Salinity, Ultraviolet radiation, Sulfates, Cellulose, Industries, Water pollution sources.
Identifiers: *Gelbstoff, *Algal substances, Subpolar waters, Tynset (Norway), Nid River (Norway), Gaula River (Norway), Flakk (Norway), Ranheim (Norway), Trondheimsfjord (Norway), Smola (Norway), Hitra (Norway), Froya (Norway), Fucus vesciculosus, Ascophyllum nodosum, Ectocarpus confervoides, Nylon column technique, Particulate matter, Blue fluorescing material, Yellow material, Fractionation.

Dissolved yellow colouring matter of terrestrial and marine waters was concentrated in nylon columns. A concentration factor of 10,000 was obtained with a recovery of approximately 70%. The method allowed isolation of a reference 'Gelbstoff' of marine origin used to estimate Gelbstoff concentrations in bog (17 milligrams/liter (mg/l)), river (about 1 mg/l), and sea water (0.003-0.8 mg/l). Seasonal and geographical variation of Gelbstoff concentration in sea water was observed. Methods based on spectra and differential spectra were inadequate for characterization of different types of yellow material from terrestrial and sea water; they are apparently derived from polyphenols. Fair separation of Gelbstoff was effected from different sources by a method of two-dimensional paper chromatography, which they developed. Marine Gelbstoff could be distinguished from both river and bog water pigments. A considerable fraction of terrestrial Gelbstoff precipitated rapidly in contact with sea water. Content and characteristics of marine Gelbstoff are variable, and is undetectable during January, February, and March. Part of the yellow color of sea water is due to particulate organic matter, which is largely amorphous and shows polyphenol staining. Precipitating Gelbstoff may be a major source of these organic aggregates. (Jones-Wisconsin)
W70-01074

ABOUT THE QUESTION OF VERTICAL MIXING OF WASTE WATERS IN CLOSED RESERVOIRS (In Russian),
A. M. Aitsam, L. L. Paal, and H. A. Tibar.
Sbornik statei po sanitarnoi tekhnike III, Trudy talinskogo politekhnicheskogo instituta, seria A, No 233, p 99-107, 1966.

Descriptors: *Mixing, Reservoirs, Mathematical models, Water pollution, Laplace's equations, Wave lengths, Waste dilution.

The problem of vertical mixing caused by wave formation is theoretically solved. This vertical mixing is dependent on the coordinates (x,y,z), on the reservoir depth, h, and on the characteristics of the wave (height, length, and period). To obtain the velocity potential, integration of Laplace's equations is necessary. Using the Lagrange integral the following equation was obtained involving the coordinate of the free surface, Z (B)= f (x,y,t). In order to solve this equation it was assumed that the height of the wave is relatively small in comparison with its length. Fourier's method was used to find the velocity potential Phi. Vertical mixing in reservoirs is caused by the vertical component of the velocity, V (2). Using a derived equation, the vertical flow of liquid through an elemental area dw= lxdx can be computed and the total mass flow of liquid was found by integration. The validity of the equations obtained was verified in a laboratory flume where a dye was used for modeling of pollution. The paper is an attempt to estimate the influence of waves on the mixing of waste waters in closed reservoirs. (Novotny-Vanderbilt)
W70-01078

SWEETWATER POLLUTION,
Larry Paul Wasserman.
Sci and Tech, No 90, p 20-27, June 1969. 8 p.

Descriptors: *Water conservation, *Water pollution, *Pollution abatement, *Fresh water, Wastes, Waste water treatment, Water pollution effects, Waterfowl, Pollutants, Radioactive wastes, Water pollution treatment, Water quality, Water resources, Fish and wildlife, Thermal pollution, Ecology, Marshes, Eutrophication, Aquatic life, Estuaries.
Identifiers: Pollution control, Biological magnification.

The earth's fresh water supply is not a constant, and is being reduced by man's wanton use. The problem arises from pollution and wasted water and from insidious circumstances resulting from such activities as land filling along shorelines and marshes. Pollution problems from sewage, industrial wastes, agricultural chemicals, and eutrophication are reviewed. Landfills of marshes, estuaries, or river shores produce adverse ecological changes, destroying valuable breeding grounds for many forms of aquatic life, waterfowl, and other wildlife. Radioactive materials released in even minute quantities present a great hazard because the radioactive material can become progressively concentrated to dangerous levels in various forms of animal life. Thermal pollution, sedimentation, and salt water intrusion problems are discussed. Current approaches to pollution problems are merely stopgap approaches. The principal ingredient needed to counteract the growing water pollution dilemma is money--money to run a conservation organization, to preserve and set aside lands, to run treatment plants, and to coordinate plans on national and state levels. (USBR)
W70-01104

CITY AIR - BETTER OR WORSE,
Public Health Service, Washington, D.C.
H. E. Landsberg.
SEC Technical Report A 62-5, Symposium, Air Over Cities, Cincinnati, Ohio, Nov 1969. 22 p, 3 fig, 4 tab, 65 ref.

Descriptors: *Temperature, *Climates, *Air pollution, Wind velocity, Precipitation.
Identifiers: *Human activities, Public hygiene.

Extreme human activity has caused considerable changes in local climates. These modifications in big cities in turn have increased the temperature by 1 to 1.5 deg F on an annual basis, diminished diurnal temperature range, flattened the shape of diurnal temperature curve, decreased the relative hu-

midity by 6%, increased the amount of precipitation by 10%, and decreased the speed of winds by 20 to 30%. In addition dust particles have increased by 10 fold, SO2 by 5 fold, CO2 by 10 fold, and CO by 25 fold. Radiation has decreased by 15 to 20% and ultra-violet radiation in the winter is 30% less. There is 100% more fog in the winter and 10% more clouds. These effects have probably only a minor influence upon human well-being. Other changes, however, have potentially harmful effects. The most radical effect has been on atmospheric suspensions and admixtures. None of these changes have been beneficial. The growth of nearly all urban areas and industrial complexes has outpaced the engineering and legal efforts to minimize the nuisance and the possible danger of contamination. Our knowledge of air quality and its effects on health is not yet adequate. In the interest of public hygiene, an intense effort in bio-meteorological and medical research is required. (Upadhyaya-Vanderbilt)
W70-01239

THE THERMAL CLIMATE OF CITIES,
Public Health Service, Washington, D.C.
J. M. Mitchell, Jr.
SEC Technical Report A62-5, Symposium, Air Over Cities, Cincinnati, Ohio, Nov 1969. 15 p, 9 fig, 2 tab.

Descriptors: *Air temperature, *Solar radiation, *Urban areas, Population, Cloud cover, Wind velocity, Lapse rate, Turbulent mixing.
Identifiers: *Urban heat island, Nocturnal inversions.

The urban 'heat island' and other aspects of the anomalous temperature distribution in San Francisco, San Jose, Palo Alto, New Haven, Vienna and a number of other cities are discussed. Heat island of a city is weaker on Sundays, when the city is comparatively dormant, than on other days of the week, when it is bustling with activity which indicates that these islands are man-made. As the city grows in size and population the increase of the intensity of urban heat island has been observed. The urban heat island is most evident at night. Daily maxima and minima of temperature are reached slightly later in the city than in suburbs, and the daily range is less in the city. The contributory causes of heat island are, on a summer day, solar radiation is more readily absorbed in the city by building and paving materials possessing large heat storage capacities, and on a winter day, the streets and buildings are warmed by the furnace heat. Sundborg found that the nighttime urban-rural temperature difference, D, could be approximated by D= (a - bN)/V where N is % cloud cover, V is wind speed, a and b are constants. (Upadhyaya-Vanderbilt)
W70-01241

5C. Effects of Pollution

EFFECT OF POLYELECTROLYTES IN CONJUNCTION WITH BENTONITIC CLAY ON CONTAMINANTS REMOVAL FROM SECONDARY EFFLUENTS,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
For primary bibliographic entry see Field 05D.
W70-00845

ESTIMATES OF PERIPHYTON MASS AND STREAM BOTTOM AREA USING PHOSPHOROUS-32,
Oak Ridge National Lab., Tenn. Radiation Ecology Section.
For primary bibliographic entry see Field 02I.
W70-00846

THE DIURETIC RESPONSE BY RAINBOW TROUT TO SUB-LETHAL CONCENTRATIONS OF AMMONIA,
Ministry of Agriculture, Fisheries and Food, London (England). Salmon and Freshwater Fisheries Lab.
R. Lloyd, and L. D. Orr.
Water Research, Vol 3, No 5, p 335-344, May 1969. 10 p, 6 fig, 19 ref.

Descriptors: *Ammonia, *Rainbow trout, *Toxicity, Lethal limit, Streams, Estuaries, Fish, Water properties, Fish management, Water temperature, Dissolved oxygen, Carbon dioxide, Alkalinity, Water quality.
Identifiers: *Diuretics, Ammonia toxicity.

Ammonia is one of the most common pollutants in rivers and estuaries. The degree of ammonia toxicity is dependent upon pH, water temperature, bicarbonate alkalinity, dissolved oxygen, carbon dioxide. The diuretic affects of ammonia on rainbow trout were studied in relation to effect of ammonia concentration, the time-lag in diuretic response, effect of temperature, and acclimation to sub-lethal concentrations of ammonia. The rate of urine excretion by rainbow trout increases with increase in the concentration of ammonia probably because of the increase in the permeability of fish to water. It is suggested that any environmental factor which affects the water balance of fish may also influence their susceptibility to ammonia poisoning. (Carstea-USGS)
W70-00848

A RAPID FOR MEASURING THE ACUTE TOXICITY OF DISSOLVED MATERIALS TO MARINE FISHES,
National Inst. for Water Research, Congella (South Africa). Regional Lab.
For primary bibliographic entry see Field 05A.
W70-00849

WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH - WATER TEMPERATURE AND INLAND FISHERIES.
European Inland Fisheries Advisory Commission. Working Party on Water Quality Criteria for European Freshwater Fish.

Water Research, Vol 3, p 645-662, 1969. 3 tab, 103 ref.

Descriptors: *Freshwater fish, *Temperature, *Effects, *Standards, Heated water, Fish food organisms, Acclimatization, Lethal limit.

In this report, tentative temperature criteria are proposed for European inland fisheries. No account is taken of the effect of pollution. It was essential to make a distinction between the temperature conditions permissible at different times of the year and to assess not only maximum permissible temperatures but also maximum permissible increments of temperature. Winter--An increase in water temperature of 2 deg C from about 0 deg C in winter at the time of reproduction of burbot would destroy this species. Raising the temperature 5-6 deg C in autumn and winter may affect salmonids. Spring--A rise of 5-6 deg C is detrimental to pike embryos. The majority of cyprinids tolerate an increase of temperature of 8-10 deg C during the embryonic stage. Adult fish can usually tolerate a wider range of temperature than embryos. It seems likely that if water temperature gets near the disturbing level most species would continue to feed. Summer--For salmonids of the genus Salmo, 20-21 deg C should be accepted as the upper permissible temperature during the warmest season of the year. Coregonids can withstand a rise of temperature of 5-6 deg C but the maximum for the summer months should not exceed 22-23 deg C. For many cyprinids, the permissible increase of temperature is about 6 deg C above the natural ambient values, with an upper limit of 30 deg C during the warmest season. (Speakman-Vanderbilt)
W70-00880

WASTEWATER DISPOSAL AND MICROBIAL ACTIVITY AT ICE-CAP FACILITIES,
Army Terrestrial Sciences Center, Hanover, N.H.
S. C. Reed, and W. Tobiasson.
Journal, Water Pollution Control Federation, Vol 40, No 12, p 2013-2020, Dec 1968. 6 fig, 1 tab, 5 ref.

Descriptors: *Ice, *Snow, *Sewage disposal, Anaerobic digestion.
Identifiers: *Thermal degradation, Greenland, *Icecap.

The physical development of the wastewater disposal pits used at two permanent stations on the Greenland Ice Cap was defined with temperature sensing themocouples and a sonic range finding device. Physical measurements indicate that the disposal pit contained within the snow mass of the ice cap grows to a diameter of 220 ft. Thermal degradation of the snow mass by this pit will have detrimental settlement effects on any facility located within 300 feet of the outfall point. Temperature of the liquid in the pit remained a constant 32 deg F. Hydrogen sulfide production was measured in the pit but methane was not detected; this indicates that at least a preliminary stage of an aerobic decomposition is occurring. (Rietveld-Vanderbilt)
W70-00882

MATHEMATICAL SIMULATION OF THE ESTUARINE BEHAVIOR AND ITS APPLICATIONS,
General Electric Co., Philadelphia; and Federal Water Pollution Control Administration, Philadelphia, Pa.
J. M. Jeglic, and G. D. Pence.
Soc Econ Planning Sci, Vol 1, No 3, p 363-389, July 1968. 27 p, 19 fig, 8 ref.

Descriptors: *Simulation analysis, *Estuarine environment, *Mathematical models, *Water quality control, *Optimization tidal waters, Forecasting, Delaware River, Dispersion, Advection, Droughts, Dissolved oxygen.

The cause and effect relationships as applied to important water quality parameters were described. Presented were the steps in the development of a mathematical model representing the dispersion and advection of dissolved oxygen in a one dimensional tidal environment, using mass balances on finite volumes. The goal of the study was to develop a rational means of estimating the cause and effect relationships, so that accurate forecasts of the results of proposed control systems could be obtained and assurances could be made that a control program had a reasonable chance of success. The verification of the model was made using a year of actual data on the Delaware estuary. During the 1965 draught the salt water intrusion in the Delaware was examined on a thirty-day basis so that corrective measures could be taken. The mathematical model presented proved to be a valuable tool in the analysis of estuarine behavior. (Thiuri-Cornell)
W70-00896

THE DEVELOPMENT AND DISTRIBUTION OF PLANKTON IN THE NORTHERN PART OF THE WHITE NILE,
Khartoum Univ. (Sudan). Dept. of Zoology.
For primary bibliographic entry see Field 02I.
W70-01007

STRONTIUM-90 CONCENTRATION FACTORS OF LAKE PLANKTON, MACROPHYTES, AND SUBSTRATES,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
Z. Kalnina, and G. Polikarpov.
Science, Vol 164, No 3887, p 1517-1519, June 1969. 3 p, 4 tab, 12 ref.

Descriptors: *Water chemistry, *Eutrophication, *Strontium radioisotopes, Sediment, Plankton,

Aquatic life, Water pollution sources, Water pollution effects, Flame photometry, Nuclear wastes.
Identifiers: *USSR, *Latvia.

The ratio of concentration of strontium-90 in living and inert lake components to that in lake water (concentration factors) was determined for plankton, macrophytes, and substrates in eutrophic, mesotrophic-eutrophic, and dystrophic lakes. Concentration factors of strontium-90 in aquatic organisms and substrates are higher in a dystrophic lake than in the other types. (Knapp-USGS)
W70-01010

PHYSICAL AND BIOCHEMICAL ASPECTS OF BOD KINETICS,
Technische Hochschule, Karlsruhe (West Germany). Lehrgebiet fur Ingieurbiologie.
Ludwig Hartmann, and Peter Wilderer.
Water Research, Vol 2, No 1, p 30-37, Jan 1968. 10 fig, 7 ref, 2 append.

Descriptors: *Biochemical oxygen demand, Biodegradation, *Water pollution effects, Activated sludge, Organic loading, Physical properties, Diffusion, Pollutants, Chemical reactions, Turbulence.
Identifiers: *Biochemical reaction kinetics, Reaction rates.

Two main theoretical concepts are generally accepted to describe the BOD process: (1) Biochemical concept considers that biochemical reactions within the cell are responsible for the reaction rates; (2) physical concept emphasizes convection and diffusion processes during the transport of organic pollutants to and through the living cell. A set of experiments used biochemical methods to evaluate and describe BOD kinetics. A constant substrate concentration was brought into contact with various amounts of activated sludge. It was impossible to use one mathematical formula to describe the whole BOD process. Second order reactions were the best approximation to evaluate the process at low load values. In this case, turbulence and other physical factors had a positive influence upon the process. Biochemical reactions were responsible for the rate of BOD reaction only at high load values. (Carstea-USGS)
W70-01024

THE CLASSIFICATION OF WATER QUALITY FROM THE BIOLOGICAL POINT OF VIEW,
For primary bibliographic entry see Field 05A.
W70-01029

THE USE OF A DIGITAL SIMULATION SYSTEM FOR THE MODELING AND PREDICTION OF WATER QUALITY,
For primary bibliographic entry see Field 05A.
W70-01030

STUDIES ON NATURAL FACTORS AFFECTING PHOSPHATE ABSORPTION AND ITS UTILIZATION BY ALGAE,
Joseph Shapiro.
Water Research, Vol 2, No 1, p 21-23, Jan 1968. 2 fig, 3 ref.

Descriptors: *Eutrophication, *Nutrients, *Water pollution sources, *Phosphates, Algae, Water pollution treatment, Water quality control, Sewage effluents, Absorption, Lakes.
Identifiers: *Phosphate absorption.

The accumulation of nutrient elements in water, particularly nitrogen and phosphorus, favors the process of eutrophication. Previous experiments have shown that different factors are present in natural waters which inhibit or facilitate the use of phosphate by algae. The 'phosphate sparing factor' was studied by using lake water and microcystis aeruginosa as the test organism. Ion exchange resins were used to determine an ionic factor that facilitated the use of phosphate by microcystis. Addition of salts increased the rates of phosphate uptake by the algae in diluted lakes; however, nitrate seemed to be the most important factor. More experimental work using different algae and chemical components are in progress. (Carstea-USGS)
W70-01031

AVOIDANCE REACTIONS OF SALMONID FISH TO REPRESENTATIVE POLLUTANTS,
John B. Sprague.
Water Research, Vol 2, No 1, p 23-24, Jan 1968.

Descriptors: *Water pollution effects, *Pollutants, Limnology, Rainbow trout, Phenols, Chlorine, Detergents, Sewage effluents, Pesticide toxicity, Toxicity, Atlantic salmon.
Identifiers: *Avoidance reactions, Salmonid fish.

Small rainbow trout or Atlantic salmon were used in laboratory experiments to test avoidance reactions against zince sulfate, phenol, ABS detergent, chlorine and bleached Kraft pulp mill effluent. Strong avoidance reaction to sublethal concentration occurred only for one (zinc sulfate) of the five pollutants used. Phenol is not avoided at all, whereas chlorine and ABS detergent could cause avoidance responses at concentrations that are expected in polluted waters. The avoidance threshold of Atlantic salmon for metal pollution was found to be about 18 times higher in nature than in laboratory tests. The salmonid fishes have different responses for different kinds of pollution depending upon the characteristics inherited from their natural habitats. (Carstea-USGS)
W70-01032

ON THE DIFFUSION PHENOMENA IN BOUNDARY LAYERS OF TURBULENT FLOW AND ITS INFLUENCE ON THE COURSE OF THE SELF-PURIFICATION OF SMALL STREAMS,
V. Novotny.
Water Research, Vol 2, No 1, p 6-8, Jan 1968.

Descriptors: *Diffusion, *Self-purification, Dissolved oxygen, Mass transfer, Turbulent flow, Oxygenation, Biochemical oxygen demand, Turbulent boundary layers, Rivers.
Identifiers: *Self-purification (Rivers).

The rate of self-purification of water is dependent upon the ratio of the bottom organisms to the river flow. The quantity of nutrients which diffuse from the free water surface to the bottom is a determining factor for the biological activity of benthic organisms. Diffusion phenomena and mass transfer of water are described mathematically. In addition to turbulent flow, a diffusive boundary layer should be considered when dealing with diffusion phenomena. A mathematical approach was applied to calculate the deoxygenation coefficient by using data from streams rich in bottom growths. Control of BOD in streams is possible if the hydraulic conditions of the stream are known. (Carstea-USGS)
W70-01037

THE INFLUENCE OF ALGAL ANTIBIOSIS ON THE ECOLOGY OF MARINE MICROORGANISMS,
Rhode Island Univ., Kingston. Narragansett Marine Lab.
John McNeill Sieburth.
Advances in Microbiology of the Sea, Academic Press, New York, Vol 1, p 63-94, 1968. 8 fig, 122 ref.

Descriptors: *Algae, *Ecology, *Marine microorganisms, Phytoplankton, Bactericides, Algal toxins, Larvae, Phenols, Shellfish, Oysters, Industries, Chelation, Bacteria, Streptococcus, Secondary productivity, Sulfides, Sea water, Phawophyta, Crustaceans, Herbivores, Chlorophyll, Enzumes, Peptides, Biochemistry, Hydrogen ion concentration, Oxidation, Diatoms, Epiphytology, Metabolism, Primary productivity, Fluorescence, Isotropy, Tritium, Symbiosis, Temperature, Copepods, Protozoa, Zooplankton, Solar radiation, Pseudomonas, Parasitism, Physiological ecology, Water pollution sources, Water pollution effects.
Identifiers: *Antibiosis, Autolysis, Excretion, Depuration, Phycocolloids, Tannins, Flagellates, Pharmaceuticals, Extracellular products, Chemical resistance, Euphausia, Phaeocystis, Sargassum, Fronds, Hydrocarbons, Bacterial attachment, Ecotocarpus, Polysiphonia, Organic aggregates, Seasonal effects.

Author reviews the role in marine ecology of antibiosis resulting from excretion of substances secondarily excreted by algae, a subject contributing to the much larger picture of microbial interactions. Photosynthetic plants are primarily important to heterotrophic microbiota as providers of primary nutritional substances. Conversely, heterotrophic bacteria may markedly influence the nutrition and success of marine plants, presumably resulting from modification of excreted and autolytic products by depolymerization and mineralization into usable nutrients, production of growth and morphogenetic factors for algae, and by detoxification of inhibitory substances. When possible, such processes should be studied in concert, rather than separately. Realization that algal products may benefit, modify, and even suppress early life stages of marine animals reemphasizes the importance of interdisciplinary attacks on ecology. Field studies promise to demonstrate factors which influence suppression, selection, dominance, and succession of marine microorganisms. Any such studies must include consideration of effects of extracellular secretions. Author summarizes his knowledge and understanding of the nature and influence of inhibitory secondary plant materials in marine environments to encourage continued investigation of algal antibiosis. (Jones-Wisconsin)
W70-01068

NITROGEN FIXATION BY GLOEOCAPSA,
North Texas State Univ., Denton. Water Research Lab.
J. T. Wyatt, and J. K. G. Silvey.
Science, Vol 165, p 908-909, Aug 1969. 1 tab, 18 ref. FWPCA Grants WP-00805-04, WP-00985-04.

Descriptors: *Cyanophyta, *Nitrogen fixation, Reduction (Chemical), Chromatography, Optical properties, Bacteria, Nitrogen cycle, Water pollution effects, Eutrophication, Cycling nutrients.
Identifiers: *Gloeocapsa, Ethylene production, Acetylene reduction, Phormidium faveolarum, Heterocyst, Chroococcus, Cylindrospermum, Nostoc muscorum, Nostoc commune, Tolypothrix distorta, Nutrient sources.

Continuous growth of the cyanophyte (blue-green alga) Gloeocapsa, in a medium free of combined nitrogen, with experimental production of ethylene via acetylene reduction, indicates that nitrogen fixation by cyanophytes is not solely confined to filamentous genera with heterocysts. Axenic cultures of Gloeocapsa, adapted to nitrate-free medium, form ethylene at rates comparable to those of known nitrogen-fixers. Special control measures precluded the possibility of responses being falsely attributed to Gloeocapsa. Authors also tested uninoculated gassed samples and cultures of Phormidium faveolarum, a non-nitrogen-fixer. Because earlier work indicated that no appreciable nitrogen fixation occurred in cyanophytes after prolonged exposure to darkness, authors adopted an arbitrary pretreatment period of 8 hours in darkness before incubation in dark-bottle and light controls. Thus, the ability of Gloeocapsa to reduce acetylene would suggest that heterocysts are not the site of nitrogen fixation, at least for this species of cyanophyte. This ability plus the facts that Gloeocapsa maintained both its vigor and an apparent normal growth rate over a period of 9 months in a medium free of combined nitrogen should establish it as a nitrogen-fixer. (Jones-Wisconsin)
W70-01070

FACTORS AFFECTING THE GROWTH OF NAJAS IN PICKWICK RESERVOIR,
National Fertilizer Development Center, Muscle Shoals, Ala.
J. B. Martin, Jr., B. N. Bradford, and H. G. Kennedy.
National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Alabama, Doc No F 70 ACD2, Oct. 1969. 19 fig, 18 tab, 8 ref, appendix.

Descriptors: *Plant growth, *Nutrient requirements, Carbon, Photosynthesis, Seeds, Sediments, Turbidity, Waves (Water), Eutrophication, Tennessee River, Industrial wastes, Municipal wastes, Nutrients, Sand, Potassium, Calcium, Magnesium, Sulfur, Alabama, Silts, Clay loam, Hydrogen ion concentration, Particle size, Iron, Copper, Manganese, Sodium, Alkalinity, Aeration, Springs, Streams, Quarries, Reservoirs, Light intensity, Tennessee, Tennessee Valley Authority Project, Sampling, Agricultural chemicals, Water pollution effects, Water pollution sources, Aquatic weeds, Bicarbonates, Carbonates, Environmental effects, Nitrates, Phosphates, Rooted aquatic plants, Sediment yield, Water quality.
Identifiers: *Najas minor, *Najas quadalupensis, *Pickwick Reservoir (Tenn-Ala), Zinc, Wilson Dam (Ala).

Authors investigated nutritional and environmental factors concerning recent infestations of Najas spp in Pickwick Reservoir (Tennessee-Alabama). Degree of infestation in any location could not be related to variations in the nutrient content of the reservoir water. Najas growth in the greenhouse was independent of nitrogen and phosphorus concentration of water, but was positively correlated with the bicarbonate ion content, the plants' source of carbon for photosynthesis via leaves and stems. Lake sediments supply inorganic nutrients via the plants' relatively weak root system. Plants rooted in a nutrient-free sand could not sustain growth, although submerged in a nutrient solution. However, variations in nutrient content of the lake sediments were apparently not responsible for presence or absence of Najas in any specific spot. That both sediments and water contribute essential factor (s) for Najas' growth is indicated by observations that plants grew normally rooted in sediment and immersed in reservoir water, whereas growth failed in similar plants immersed in demineralized water. Water depth, sediment load, turbidity, light penetration, seed introduction, wave action, and other environmental factors were cited as the controlling factors in distribution of Najas. Report includes appendix outlining analytical techniques and methods for greenhouse culture of Najas. (Jones and Nichols-Wisconsin)
W70-01071

SEASONAL CHARACTERISTICS OF TWO SALINE LAKES IN WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W70-01076

SOME LIMNOLOGICAL FEATURES OF A SHALLOW SALINE MEROMICTIC LAKE,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W70-01077

LIMNOLOGICAL EFFECTS OF ORGANIC EXTRACTS OF LITTER IN A SOUTHWESTERN IMPOUNDMENT,
Arizona Univ., Tucson; and Arizona Cooperative Fishery Unit, Tucson.
For primary bibliographic entry see Field 02H.
W70-01080

POLLUTION--CAUSES, COSTS, CONTROLS.
For primary bibliographic entry see Field 06B.
W70-01100

IMPLICATION OF WATER QUALITY AND SALINITY IN THE SURVIVAL OF FRASER RIVER SOCKEYE SMOLTS,
International Pacific Salmon Fisheries Commission, New Westminster (British Columbia).
I. V. Williams.
International Pacific Salmon Fisheries Commission Progress Report, No 22, 1969. 8 fig, 15 tab, 25 ref.

Descriptors: *Sockeye salmon, *Herbicides, *Pesticides, *Salinity, Marine salmon, Metals, Detergents, Water quality.
Identifiers: *Migration seaward, *Marine survival, *Salinity preference, *Fraser River.

Seaward migrating juvenile sockeye (Oncorhynchus nerka) from five lakes in the Fraser watershed were examined in a preliminary attempt to define some of the factors causing variable marine survival to the adult stage. Water quality of rivers utilized by the seaward migrating smolts appeared to be acceptable. No toxicants in the form of heavy metals, herbicides, pesticides, or detergents were detected at lethal threshold concentrations. At the onset of migration, the different groups varied in their tolerance of sea water, but all could tolerate 30 parts per thousand (0/00) salinity within the time required to reach the estuary. Preference tests of smolt behavior in a vertical salinity gradient indicated a time lag from the onset of migration to the acceptance of sea water which increased in proportion to the distance between the individual lake of origin and the estuary. However, once each group of smolts had accepted sea water, little or no acclimation was needed to transfer smolts from fresh water directly into 30 0/00 salinity. A delay in salinity preference and tolerance relative to the onset of seaward migration is suggested as a possible factor related to variation in marine survival of sockeye smolts.
W70-01225

PATTERNS OF INSECTICIDE RESISTANCE IN THE MOSQUITOFISH, GAMBUSIA AFFINIS,
Mississippi State Univ., State College. Dept. of Zoology.
Dudley D. Culley, and D. E. Ferguson.
Journal Fisheries Research Board of Canada, Vol 26, No 9, p 2395-2401, 1969. 3 tab, 15 ref.

Descriptors: *Pesticide toxicity, *Chlorinated hydrocarbon pesticides, *Fish, Bioassay toxicity, *Organophosphorous pesticides.
Identifiers: *Mosquito fish, *Pesticide resistance.

The insecticide resistance of a resistant mosquitofish population (Belzoni, Miss.) was compared to that of a sensitive population using 28 insecticides of 5 major groups (chlorinated hydrocarbons and organic phosphorous compounds). The 48-hour bioassay showed that the resistant fish had developed a tolerance only to the toxaphene-endrin related insecticides. The patterns of resistance in mosquitofish are similar to those in many resistant arthropods. (Katz-Washington)
W70-01226

WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH; LIST OF LITERATURE ON THE EFFECT OF WATER TEMPERATURE ON FISH.
Food and Agriculture Organization of the United Nations, Rome (Italy). European Inland Fisheries Advisory Commission.

European Inland Fisheries Advisory Commission, Working Party on Water Quality Criteria for European Freshwater Fish, EIFAC Tech Paper No 8, Rome 1969. 8 p, 110 ref.

Descriptors: *Fish physiology, *Water temperature, *Bibliographies, Fish, Water pollution, Water quality.
Identifiers: *Water quality criteria, *Thermal pollution, *Temperature effects, *Temperature requirements.

A bibliography of over 100 references on the literature regarding the water temperature requirements of freshwater fish. Good coverage of Eastern European literature. (Katz-Washington)
W70-01227

WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH; REPORT ON WATER TEMPERATURE AND INLAND FISHERIES BASED MAINLY ON SLAVONIC LITERATURE.
Food and Agriculture Organization of the United Nations, Rome (Italy). European Inland Fisheries Advisory Commission.

European Inland Fisheries Advisory Commission, Working Party on Water Quality Criteria for European Freshwater Fish, EIFAC Tech Paper No 6, Rome, 1968. 32 p, 85 ref.

Descriptors: *Fish, *Water pollution, *Water temperature, *Water quality, Fish physiology, Bibliographies, Acclimatization.
Identifiers: *Water Quality Criteria, *Temperature range, *Temperature acclimatization, *Seasonal temperature tolerance, *Salmonid temperature tolerance, Developmental stage.

A review of the European literature on thermal requirements of European Freshwater fish with particular attention to Eastern European sources and review which is designed to help formulate water quality criteria, indicate that fish differ in tolerance to high temperature. Tolerance varies with species, stage of development, acclimatization temperature, dissolved oxygen, and other pollution sources. In this review, temperature criteria are proposed which take no account of other pollution. Different temperatures are permissible at different times of the year. For salmonids, 20 to 21 deg C is the upper permissible temperature during summer while cyprinids can tolerate 30 deg C. (Katz-Washington)
W70-01228

CHRONIC TOXICITY OF ZINC TO THE FATHEAD MINNOW, PIMEPHALES PROMELAS RAFINESQUE,
Newton Fish Toxicology Lab., Cincinnati, Ohio.
William A. Brungs.
Transactions of the American Fisheries Society, Vol 98, No 2, p 272-279, Apr 1969. 8 tab, 1 fig, 16 ref.

Descriptors: *Bioassay, *Fish reproduction, Toxicity, Freshwater fish, Metals.
Identifiers: *Continuous flow bioassay, *Fathead minnow, *Chronic toxicity, *Fish production, *Fish survival, *Fish growth, Zinc, Application factor, 96-hr. median tolerance limit.

A continuous-flow bioassay was conducted for 10 months to determine the chronic effect of zinc on fathead minnows (Pimephales promelas Rafinesque). Fish porduction, as based on survival, growth, and reproduction, was investigated. Reproduction by the test fish was almost totally inhibited at zinc concentrations that had no effect on survival, growth, or maturation of these same fish. At these same concentrations there was also no effect on survival of control eggs and fry. The number of eggs produced per female in the low zinc concentration (0.18 mg/l) was only 17 percent of the eggs produced in the control (0.03 mg/l of zinc). Application factors based on these data and the 96-hour median tolerance limit (9.2 mg/l) are discussed. (Katz-Washington)
W70-01229

OIL POLLUTION OF THE SEA: IS THE END IN SIGHT,
Fauna Preservation Society, London (England).
C. L. Boyle.
Biological Conservation, Vol 1, No 4, p 319-327, July 1969. 1 tab, 2 fig, 25 ref.

Descriptors: *Oily water, *Birds, Waste water disposal.

Identifiers: *Oil pollution marine, *Oil discharge, *Marine fauna, *Marine birds, *Cleaning marine birds, *Oiled marine birds, Deliberate oil pollution, International Conference on Oil Pollution of the Sea, Corexit, Oil slicks.

The chief cause of deliberate oil pollution at sea, the cleaning of oil tanks, is discussed and means of abolishing the practice are discussed. The effects of oiling on marine fauna, especially on birds, is discussed. Methods of cleaning oil from birds are described. The effects on shore life observed by the South African division of Sea Fisheries are reported. The toxic effects of oil slick dipersants (Corexit) on various aquatic forms are reported. (Katz-Washington)
W70-01230

RECOVERY OF A SALT MARSH IN PEMBROKESHIRE, SOUTH-WEST WALES, FROM POLLUTION BY CRUDE OIL,
Field Studies Council, Pembroke (England). Oil Pollution Research Unit.
E. B. Cowell, and J. M. Baker.
Biological Conservation, Vol 1, No 4, p 291-296, July 1969. 2 fig, 2 tab, 8 ref.

Descriptors: *Algal poisoning, *Marsh plants, *Oily water, Aquatic algae, Marine algae, Oil, Marsh, Pollutants.
Identifiers: *Salt marsh, *Oil pollution, *Recovery from pollution, *Kuwait crude, Bentlass Salt Marsh.

An account of the biological effects of a spill of Kuwait crude oil on the plants and algae of the Bentlass Salt Marsh near Pembroke, S.W. Wales. Some species of the marsh plants were more affected by the oil than others. Spill occurred in January 1967 but by June 1968, most of the species affected were showing some signs of recovery with the exception of Triglochin maritima. No animal observations. (Katz-Washington)
W70-01231

FISHERY MANAGEMENT WITH THE HELP OF THE ORGANOPHOSPHORUS INSECTICIDE, THIOMETON,
Bihar Univ., Muzaffarpur (India). Dept. of Zoology.
S. K. Konar.
Ichthyologica, Vol IV, Nos 1-2, p 28-36, 1965. 5 tab, 8 ref.

Descriptors: *Insecticides, *Fish control agents, *Fish management, *Piscicides, *Organophosphorus pesticides, Fish farming, Aquatic insects.
Identifiers: *Thiometon, Toxicity bioassays, Labeo, Notonecta.

Experiments were conducted to determine usefulness of Thiometon, an organic phosphorus insecticide in the management of the pond fish Labeo. The minimum lethal doses of Thiometon to Labeo and nine species of undesirable organisms was determined. The LD0, LD50, LD100 of Thiometon vary from 0.50 to 6.4 ppm, 0.32 to 13.49 ppm, and 0.56 to 20 ppm respectively for fishes and from 0.008 to 0.40 ppm, 0.035 to 0.835 ppm and 0.05 to 2.0 ppm for insects. Except for Cyclops and Nauplius, all fish food organisms tolerate 1 ppm Thiometon. Thiometon is detoxified in 8 days in the field. (Katz-Washington)
W70-01232

A COMPOSITE RATING OF ALGAE TOLERATING ORGANIC POLLUTION,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
C. M. Palmer.
Journal of Phycology, Vol 5, No 1, p 78-82, 1969. 11 tab, 29 ref.

Descriptors: *Algae, *Aquatic algae, *Aquatic environment, Pollutants, Biological communities, Water pollution effects, Diatoms.
Identifiers: *Pollution-tolerant algae, *Blue green algae, *Euglena, Pigmented flagellates.

From information on pollution-tolerant algae compiled from reports from 165 authors, the genera and species most often referred to as significant fall into a relatively stable series. Diatoms, pigmented flagellates, green, and blue-green algae are all well represented among the pollution-tolerant genera and species. The top 8 genera are Euglena, Oscillatoria, Chlamydomonas, Scenedesmus, Chlorella, Nitzshcia, Navicula, and Stigeoclonium, and the top 5 species, Euglena viridis, Nitzschia palae, Oscillatoria limosa, Scenedesmus quadricauda, and Oscillatoria tenuis. In some genera, e.g., Euglena, a single species is far more significant than all others as a pollution-tolerant form. In other genera, e.g., Oscillatoria, only a slight difference distinguishes the pollution tolerance of 2 or more species. Algal genus and species pollution indices are presented for use in rating water samples with high organic pollution. (Katz-Washington)
W70-01233

SOME OBSERVATIONS OF CLOUD INITIATION IN INDUSTRIAL AREAS,
Public Health Service, Washington, D.C.
G. E. Stout.
SEC Technical Report A62-5, Symposium, Air Over Cities, Cincinnati, Ohio, p 147-153, Nov 1969. 2 fig.

Descriptors: *Clouds, *Air pollution, *Temperature, Tornadoes.
Identifiers: Industrial pollution.

Landsberg and Changnon have suggested that precipitation over an urban area is greater than over the rural area. Telford, of the CSIRO in Australia recently concluded that a portion of freezing nuclei in the atmosphere comes from certain types of industrial activity. A petro-chemical industry, located in the rural area of central Illinois, has been observed to initiate clouds. At least five cases are partially documented by surface, airborne, or radar observations. On one occasion a cumulus congestus cloud formed and produced tornado funnels. These clouds were formed at a small distance down wind from the heat source. No other clouds were present in the area. Preliminary occasional observations suggest that this industrial source could be used for an interesting reaearch study of the possible influence of industrial pollution on cloud formation. (Upadhyaya-Vanderbilt)
W70-01240

5D. Waste Treatment Processes

EFFECT OF POLYELECTROLYTES IN CONJUNCTION WITH BENTONITIC CLAY ON CONTAMINANTS REMOVAL FROM SECONDARY EFFLUENTS,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
M. Rebhun, N. Narkis, and A. M. Wachs.
Water Research, Vol 3, No 5, p 345-355, May 1969. 11 p, 7 fig, 1 tab, 16 ref. Work partially sponsored by US Dept of Agri. Grant No FG-IS-148, USDA.

Descriptors: *Tertiary treatment, *Clays, *Coagulation, *Adsorption, *Flocculation, *Water reuse, Water quality, Water pollution, Chemical oxygen demand, Turbidity, Color, Organic matter, Phosphates, Nitrogen compounds, Organic compounds, Water purification.
Identifiers: *Residual organic removal, Secondary effluents.

The efficiency of flocculation by polyelectrolytes and clays in removing the residual organics and other refractory matter from secondary effluents was investigated. Attempts were made to clarify the mechanisms of interaction between the polyelectrolyte, the clay in the various refractory organics in secondary effluents. The parameters studied include chemical oxygen demand, turbidity, color phosphate, nitrogenous compounds, and ABS. Cationic polyelectrolytes react with various substances in solution, particularly anionic organic matter. The reaction products are colloidal and do not settle rapidly. The bentonite removes some organic compounds, mostly nitrogenous organics. The mixture of benonite and cationic polyelectrolytes improve the efficiency of organic removal and lowers the required flocculant dose. The clay itself removes 74% of the total COD. The surface reactions and mechanisms are also discussed in this paper. (Carstea-USGS)
W70-00845

THE USE OF THE FUNDAMENTAL STUDIES OF BIOLOGICAL PURIFICATION ON THE PURIFICATION OF POLLUTED WATERS DERIVED FROM PRODUCTION OF 'KHEMLON' (SLOVAKIAN),
Zdena Nanackova-Zekeova.
Russian and German summaries. Vyskumny Ustav Vodohospodarsky, Bratislavia, 1966. 79 p, 14 fig, 13 tab, 25 ref.

Descriptors: *Industrial wastes, *Industrial water, *Pollution abatement, *Biological treatment, Cotton, Runoff, Silts, Oxygen, Stagnant water, Phosphorus, Nitrogen, Air circulation, Oxidation, Biodegradation, Water reuse, Waste water treatment.
Identifiers: *Slovakia, Industrial waste water, Biological purification.

Purification of industrial waste water from the production of cotton material was investigated by using a method of silt activation. The success of the method depends on the concentration of fresh running water, optimal load, optimal time period of activation, concentration of activated silt, amount of feeding material, and the intensity of air circulation. The efficiency of purification also requires some addition of phosphorus, usually absent in fresh running waters. (Gabriel-USGS)
W70-00879

NUCLEAR POWER PLANT SITING IN THE PACIFIC NORTHWEST FOR THE BONNEVILLE POWER ADMINISTRATION,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
H. Harty, R. F. Corlett, and R. E. Brown.
Summary Research Report, Battelle-Northwest, July 1967. 50 p, 16 fig.

Descriptors: *Thermal pollution, *Cost analysis, Nuclear power plant.
Identifiers: *Siting consideration, *Public acceptance factor, *Site economic factor, Pacific Northwest site areas.

The factors which are taken into account for site selections are physical and environmental site factors, population of surrounding areas, geology and hydrology, meteorology, heat dissipation and biological effects. The significant factors in site cost are condenser size and cost, natural- and induced draft cooling towers, land and site preparation costs, site access, engineered safeguards and multiple-reactor siting. For the sites considered, the method of handling waste heat was the single most important economic variable. It was found that once-through cooling with fresh water was the most economical method of disposing of waste heat. Once-through cooling with salt water increased capital costs about $3/kW and unit power costs about 0.045 mill/kW-hr. The use of cooling towers for waste heat discharge increased capital costs about $10/kW and unit power costs about 0.14 mill/kW-hr. A major economic tradeoff exists among the method of handling waste heat, transmission costs, engineered safeguards costs (which tend to increase as sites approach many load centers, i.e., urban areas), land costs (generally higher near urban areas) and other factors. (Upadhyaya-Vanderbilt)
W70-00883

COPING WITH COOLING TOWER BLOWDOWN,
T. C. Hoppe.
Industrial Water Engineering, p 27-32, Dec 1966. 5 fig, 8 ref.

Descriptors: *Thermal pollution, *Cooling tower, Chemical waste, Corrosion control, Cost comparison, Films.
Identifiers: *Corrosion inhibitor, Cooling water treatment, Tuberculation.

A case study is presented of industrial cooling water treatment with inflow process temperatures of 116F to 350F, and 90F to 140F out, with a maximum water temperature differential across the tower of 31F. Well water was treated with acid for pH control, shock chlorination for biocide, and non-chromate proprietary blend of polyphosphates and polyvalent ions for corrosion inhibition. Operating experience showed severe corrosion and iron oxide and phosphate sludge deposits. A new corrosion inhibitor in the form of zinc, and biodegradable organic material, without chromate nor phosphates, was tried. Very good results were obtained, uniform protective film formation was evident, previous tuberculation decreased, and no sludge accumulated. Costs rose from $0.0606 to $0.1275 per 1000 gallons of makeup, but this was far less expensive than other alternatives. (Rietveld-Vanderbilt)
W70-00884

COOLING TOWERS FOR STEAM-ELECTRIC STATIONS - ECONOMIC APPLICATIONS,
Ebasco Services Inc., New York.
Louis Elliott.
Transactions of the American Society of Mechanical Engineers, Vol 73, p 1027-1029, 1951. 3 fig, 1 tab.

Descriptors: *Cooling towers, *Steam, *Economic efficiency, Heated water, Condensation.

The objective of this study was to indicate a method for an economic comparison between direct use of river or pond water for condensing arrangement for a steam station and utilization of cooling towers. The comparison was made utilizing data on river temperatures and records of atmospheric temperature and humidity over a longer period. In a particular case studied, maximum plant capability of a cooling tower plant as compared with a direct condensing, is penalized by from 2 to 3 percent. Remarks on the cooling tower performance, location and orientation of towers are mentioned. Because a great deal of information is necessary to determine the best placement of a tower, research needs are mentioned. (Guerrero-Vanderbilt)
W70-00887

CATAD SYSTEM CONTROLS FOR REGULATION OF COMBINED SEWAGE FLOWS,
Municipality of Metropolitan Seattle, Wash.; and Metropolitan Engineers, Seattle, Wash.
Charles V. Gibbs, and Stuart M. Alexander.
Water and Wastes Eng, p 46-49, Aug 1969. 2 fig.

Descriptors: *Mathematical models, *Computer programs, *Sewers, *Storage capacity, *Storm runoff, Sewage disposal, Minicipal wastes, Automatic control, Hydrologic properties.
Identifiers: Combined sewers.

The installation of a computer-augmented treatment and disposal (CATAD) system to utilize optimum storage within an existing municipal combined sewer system was described. The other objectives of CATAD were (1) to make available the maximum capacity of the interceptor for combined storm and sanitary flows in unseparated areas by utilizing the storage capability of trunk and interceptor sewers in separated areas; and (2) to control necessary overflows at selected locations so as to minimize harmful effects on marine life and public beaches. Control commands were generated internally by a computer under program control. A mathematical model was developed in order to implement a fully automatic control. The model incorporated elements of meteorology and hydrology including seasonal precipitation patterns and areal runoff characteristics. An analysis of the regulation of stormwater inflows by the use of trunk sewer storage established the operating rules required for effective utilization of the available storage. (Thiuri-Cornell)
W70-00889

ANALYSIS AND OPTIMIZATION OF A REVERSE OSMOSIS PURIFICATION SYSTEM--PART II. OPTIMIZATION,
Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
For primary bibliographic entry see Field 03A.
W70-00890

OPTIMIZATION OF THE ACTIVATED SLUDGE PROCESS-OPTIMUM VOLUME RATIO OF AERATION AND SEDIMENTATION VESSELS,
Kansas Univ., Lawrence. Dept. of Chemical and Petroleum Engineering; and Kyoto Univ. (Japan). Dept. of Chemical Engineering.
M. Naito, T. Takamatsu, and L. T. Fan.
Water Res, Vol 3, No 6, p 433-443, June 1969. 8 fig, 6 ref.

Descriptors: *Optimization, *Activated sludge, *Aeration, *Sedimentation, *Mathematical models, Mixing, Sludge treatment, Capital, Design, Volume.
Identifiers: Recirculated sludge.

A mathematical model was developed for optimizing the total activated sludge system. The optimum volume ratio of the aeration and sedimentation tanks and the recirculation ratio of the sludge were computed. The objective of the two computations was the minimization of the total capital cost and the total volume. Both objective functions gave almost the same results. Total capital cost increased with the increase of the mixing in the aeration tanks. The results obtained in the study were for steady state operation. It was found out that the optimum volume ratio of the aeration to sedimentation tanks and sludge recirculation did not vary greatly from the design conditions adopted in current plants. (Thiuri-Cornell)
W70-00893

A SYSTEMS APPROACH TO WASTE MANAGEMENT,
Massachusetts Univ., Amherst.
Richard J. Giglio, Donald D. Adrian, Frank C. Kaminsky, and Robert F. Rikkers.
Proc, Fourth Amer Water Resources Conf, NY, p 344-353, Nov 1968. 10 p, 2 fig, 9 ref.

Descriptors: *Systems analysis, *Waste water treatment, *Optimization, *Regional analysis, *Decision making, Planning, Mathematical models, Computers, Treatment facilities, Interception, Cost allocation, Water management (Applied).

The use of systems analysis to optimize regional planning for waste water systems was described. The objective of the study was to develop a methodology and mathematical-computer models which could aid planning agencies to make decisions concerning regional development. A region in Massachusetts was selected for the pilot application. A waste system was divided into the following subsystems; collection facilities, interceptors, various types of treatment plants, storage facilities and the stream. Engineering and economic data were used to describe and model each subsystem. Optimization techniques then helped define the most efficient configuration of subsystems for regions with differing characteristics. Attention was also given to procedures for implementing the plans and equitably allocating costs among communities. (Thiuri-Cornell)
W70-00898

RADIOTRACER STUDY OF RAPID SAND FILTRATION,
Georgia Inst. of Tech., Atlanta.
Thomas Fisher Craft, Jr.
Available from the Clearinghouse as PB-187 522, $3.00 in paper copy, $0.65 in microfiche. Water Resources Center, Georgia Institute of Technology, Partial Completion Report WRC-0469, August 1969. 179 p. OWRR Proj B-020-GA.

Descriptors: *Rapid sand filtration, *Porous media filter, *Drinking water treatment, *Radioactive tracers, *Filtering system, Cesium-137, Filter sands, Radioisotopes, Adsorption, Particle shape, Particle size, Pores, Porosity, Colloids, Flocculation.

The research was designed to investigate the mechanism by which suspended particles are removed from flowing water during passage through a porous medium. Particles labeled with radioactive Cesium-137 were suspended in water and passed into a laboratory scale filter built to simulate a commercial water filter. Radiation detection equipment was used to follow the radioactive particles. Three different sizes of sand and ground anthracite were used as filter media. The pattern of deposition was found to depend on the absolute and relative sizes of the suspended particles and the stationary grains. In a given filter medium, particle removal was found to vary directly with the particle diameter. For a given particle size, removal was found to vary inversely as the diameter of the filter bed grains. Interdependence of grain and suspended particle dimensions is such that the filter coefficient was found to vary inversely in a linear fashion with the ratio of pore diameter to particle diameter for ratios of about five or less. Additional work is needed to relate the ideal laboratory conditions to actual conditions encountered in the field. (Conway- Georgia Tech)
W70-00910

THE INFLUENCE OF SUSPENDED SOLIDS ON THE RATE OF OXYGEN TRANSFER IN AQUEOUS SOLUTIONS,
G. T. M. Van der Kroon.
Water Research, Vol 2, No 1, p 26-30, Jan 1968. 5 fig.

Descriptors: *Dissolved oxygen, *Oxygenation, *Respiration, *Suspended load, Solid wastes, Dissolved oxygen analyzers, Waste assimilative capacity, Activated sludge, Gases, Microorganisms, Clays, Laboratory tests.
Identifiers: *Oxygen transfer, *Holland, Rotterdam, River pollution, Sludge liquor.

The relationship between dissolved-oxygen content and the rate of respiration of microorganisms was studied in a mixed liquor from activated sludge plants and in Rotterdam tap water. The experimental apparatus allowed for a constant rate of gas flow and injection of oxygen when its partial pressure in the gas decreased. The oxygenation capacity and maximum rate of oxygen absorption were measured and the ratio between them was plotted against suspended solids concentration. It was concluded that the suspended solids concentration played an important role in the oxygen transfer in various solutions. The properties of clay and aluminum sulfate suspensions resembled those of a mixed liquor with respect to oxygen transfer. (Carstea-USGS)
W70-01023

MODIFIED FILTER MEDIA FROM REMOVAL OF WATER POLLUTANTS,
C. D. Agarwal, and A. V. S. Prabhakara Rao.
Water Research, Vol 2, No 1, p 43-45, Jan 1968. 6 ref.

Descriptors: *Water pollution treatment, *Filtration, *Water pollution control, *Filters, Sewage effluents, Electrolytes, Zeta potential, Bacteria, Protozoa, Algae, Solid wastes, Tertiary treatment.
Identifiers: Polyelectrolyte-coated filters, Bauxite.

A simple filter was developed for efficient removal of micronesized particles. These particles include some bacteria, protozoa, algae, cysts, and even some worms. Sewage particles carry small electrokinetic charges (surface zeta potentials), which are generally negative. The efficiency of filtration can be greatly improved if the filter media are coated with cationic polyelectrolytes to retain the negatively charged particles. The experimental results obtained by using bauxite coated filters were comparable with those using polyelectrolytes. The economics of the designed criteria for this filration progress are evaluated. (Carstea-USGS)
W70-01027

STREAM REAERATION USING MOLECULAR OXYGEN,
For primary bibliographic entry see Field 05G.
W70-01028

AN EXAMINATION OF THE BENEFITS AND DISADVANTAGES WITH RESPECT TO THE DISPOSAL OF SOLID WASTES,
American Society of Civil Engineers, New York.
Donald H. Waller.
Available from Clearinghouse as PB-186 006 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 10, Feb 1, 1968. 54 p, 2 fig, 1 tab, 21 ref. FWPCA Program No 11020 EKO.

Descriptors: *Cost-benefit analysis, *Deposition (Solid wastes), *Sewage treatment, Pressure conduits, Sewers, Solid wastes.
Identifiers: Grinding, Solid waste characteristics, Transport velocity.

Important considerations in an evaluation of the feasibility and benefits of adapting any sewerage system to solid wastes disposal are: the extra solids load that community refuse could add to a sewage disposal system; velocities required to move solid wastes and the effect of flow variations on sewer velocities; solid wastes separation practices and attitudes toward separation of household refuse; the need for grinding, and considerations involved in the development of a household refuse grinding device; the effects of solid wastes on sewage treatment processes; and costs and benefits involved in evaluation of alternative systems for disposal of sewage and solid wastes. Considerations peculiar to the ASCE Project scheme are: the possibility of adapting building sewage storage-grinder-pump units for handling solid wastes; the need to discharge solid wastes into the system under pressure; reduced clearances in the small pipes of a pressure system; and the possibility of greater solids deposition at low flows. Appendices include information on: composition and characteristics of solid wastes; pertinent solid wastes research and development; and results of research on transport and treatment of solid wastes in sewage disposal systems. (Tucker-ASCE)
W70-01063

5E. Ultimate Disposal of Wastes

WASTEWATER DISPOSAL AND MICROBIAL ACTIVITY AT ICE-CAP FACILITIES,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 05C.
W70-00882

OIL FIELDS YIELD NEW DEEP-WELL DISPOSAL TECHNIQUE,
Halliburton Co., Duncan, Okla. Dept. of Chemical Research and Development.
K. A. Slagle, and J. M. Stogner.
Water and Sewage Works, Vol 116, No 6, p 238-244, June 1969. 7 p, 5 fig, 13 ref.

Descriptors: *Waste disposal, *Injection wells, Fractures (Geology), Permeability, Well casings, Monitoring, Oil industry, Geology, Waste treatment, Waste water disposal, Solid wastes.
Identifiers: *Well construction.

The predominant practice of injecting liquid wastes into permeable or naturally fractured subsurface strata is not the only method for the disposal of pollutants in deep wells. Utilizing other oil field operations such as hydraulic fracturing and other modifications may eliminate some common objections to this procedure-- lack of suitable formations, expensive pre-injection equipment and treatment, and production of a secondary waste presenting in itself a disposal problem. Each particular waste disposal problem should be treated as a separate entity since the problems involved are so different throughout the various industries. A second waste disposal well, or a stand-by well, should be considered if the production of waste is such that general plant production may be interrupted or there is a possibility of discharging effluent into public streams or waters. A monitoring well system should be included to help detect or determine possible contamination or damage to fresh water aquifers and other minerals. Design of the well casing and equipment should be given serious consideration and the utmost in design precautions taken to provide maximum protection and longevity. Under normal low pressure disposal operation where naturally fractured formations are used, low pressure equipment may be utlized with pre-injection treatment facilities. (Knapp-USGS)
W70-00990

5F. Water Treatment and Quality Alteration

A SYSTEMS APPROACH TO WASTE MANAGEMENT,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05D.
W70-00898

CAUSES AND CONSEQUENCES OF POND EUTROPHICATION (POLISH),
Polish Academy of Sciences, Krakow.
Stanislaw Wrobel.
English summary. Acta Hydrobiologica, Vol 7, No 1, p 27-52, 1965. 15 fig, 6 tab, 28 ref.

Descriptors: *Eutrophication, *Fertilization, *Nitrogen compounds, *Phosphorus compounds, *Thermal stratification, *Oxygenation, Organic matter, Respiration, Copper sulfate, Lime, Dissolved oxygen, Fish, Fish parasites, Water quality control, Water quality.
Identifiers: Fish respiration, Fish density, Carp culture, Branchiomyces sanguinus, Golysz Experimental Station (Poland), Water quantity, Water exchange, Oligotrophy, Polytrophy.

Results are reported of attempts to increase productive capacity of ponds by application of lime, and nitrogen- and phosphorus-fertilizers to encourage eutrophication, and by additions of copper sulfate to control excessive algal growth. Such management revealed a sequence of three trophic levels: oligotrophic, before fertilization; eutrophic, during fertilization; and polytrophic, during the intensive fish feeding. The latter phase induced periodic acute oxygen deficiency, endangering respiratory organs of fish and inviting the invasion of fish gills by Branchiomyces sanguinis. Maintenance of an adequate degree of water oxygenation requires control of organic matter content, occasional exchange of water of the pond, and a correlation of fertilization, feeding, and density of fish with the amount of inflowing water. (Wilde-Wisconsin)
W70-01082

5G. Water Quality Control

NUCLEAR POWER PLANT SITING IN THE PACIFIC NORTHWEST FOR THE BONNEVILLE POWER ADMINISTRATION,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 05D.
W70-00883

WATER QUALITY AND REGIONAL ECONOMY, A DECISION MODEL,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
David L. Raphael, and James Maugeri.
Proc, Fourth Amer Water Resources Conf, NY, p 132-139, Nov 1968. 8 p, 3 tab, 5 ref.

Descriptors: *Water quality, *Industrial water, *Decision making, *Leontief models, *Input-output analysis, *Pollution abatement, Water supply, Taxes, Waste water treatment, Economics, Regional analysis.

A Leontief input-output economic model was constructed to demonstrate how such a model could be utilized to bring rationality into regional decision making with respect to a specific water quality problem. Clinton County, located in Central Pennsylvania, was chosen for the study. The industry selected was a paper mill located in the county. It was assumed that the water quality was so poor that a substantial cost would be incurred by the industry in order to bring its quality to a usable level. It was also assumed that if the cost became prohibitive the industry would leave the county. Three alternatives were considered (1) closing the plant, (2) tax forgiveness, and (3) providing the plant with water of sufficient quality from local water utilities. It was concluded that (1) the penalty paid by the region by the closing of the mill was extremely large, (2) that the tax forgiveness amount could be passed along to the household sectors as a local tax increase thus returning the region to the status quo, and (3) that if the local utility could handle the increased needed supply at reduced income, the region would retain the mill and realize increased economic activity as well. (Thiuri-Cornell)
W70-00897

LOWER MISSISSIPPI RIVER BASIN DEVELOPMENT DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00912

THE CONSTITUTIONAL ASPECTS OF WATER POLLUTION AND THE NEED FOR GOVERNMENTAL COOPERATION,
Brian A. Stamp.
Agassiz Center for Water Studies Research Report, Univ of Manitoba, Vol 1, No 2, ch 7, 1968. 25 p, 42 ref.

Descriptors: *Water pollution control, *Water pollution, *Federal-state water rights conflicts, *Governments, Federal government, State governments, Natural resources, Political aspects, Water conservation, Water resources, Water supply, Jurisdiction, Federal jurisdiction, State jurisdiction, Water policy, Water quality, Water quality control, Impaired water quality, Public health, Administrative agencies, Fish management, Stream improvement, Navigable waters, Navigation, Legal aspects.
Identifiers: *Canada.

In Canada, jurisdiction over water pollution is divided between the provincial and federal governments. Under the criminal law power, Parliament may enact criminal legislation aimed at pollution as a danger to public health, and it is also authorized to set up an administrative body to regulate pollution and to enforce such legislation. The general power under the peace, order, and good government clause would allow the federal government to cure existing pollution and to prevent such pollution in the future. Legislative jurisdiction over fisheries extends to controlling water quality that might affect fish. The navigation and trade and commerce powers are of limited significance in this respect. The provinces have authority in the field of pollution control since ownership of water is vested in the provinces and since the problems have a valid local aspect. The provinces are authorized to

set up needed physical works. Since the pollution problem has both federal and provincial aspects, it is logical that it be solved at both levels with legislative programs complementing one another. (Douberley-Florida)
W70-00915

STATUTORY STREAM POLLUTION CONTROL,
Seymour C. Wagner.
U Pa L Rev, Vol 100, No 2, p 225-241, Nov 1951. 17 p, 115 ref.

Descriptors: *Pennsylvania, *Pollution abatement, *Water pollution control, *Water pollution sources, Acid mine water, Bacteria, Coal mine wastes, Legislation, Legal aspects, Judicial decisions, State governments, Industrial wastes, Mine acids, Pollutants, Sewage effluents, Sewage treatment, Water pollution effects, Chemical wastes, Municipal wastes, Water pollution treatment, Water quality control, Water quality, Stream improvement, Economic feasibility.

Using the highly industrialized and populous state of Pennsylvania, this note discusses: (1) various legal methods available on pollution abatement; (2) problems which municipalities, industries and the public encounter in meeting pollution control obligations; (3) types of pollution and the necessity for treatment of pollutants as well as their prohibition; (4) the problem of coal related pollution; (5) failure of common-law and equity enforcement in pollution control; (6) the necessity of interstate and federal action; (7) the development of statutory pollution control; and (8) the financial burden of stream purification. The note also examines statutory enforcement in the areas of industrial wastes and municipal sanitation along with statutory remedies. It is concluded that conflicting economic interests, excessive financial burdens, and unsolved engineering problems must all be considered in long range pollution control. The task of water pollution control boards must be to advance programs by determining which interests have valid claims and by calling for legislative and judicial aid where needed. The case of Pennsylvania Coal Co. v. Sanderson, 6 Atl 453 (1886) is discussed. (Marsee-Florida)
W70-00923

STATUTORY STREAM POLLUTION CONTROL,
Seymour C. Wagner.
U Pa L Rev, Vol 100, No 2, p 225-230, Nov 1941.

Descriptors: *Pennsylvania, *Pollution abatement, *Water pollution control, *Pollutants, Water pollution sources, Bacteria, Acid mine water, Coal mine wastes, Legislation, Legal aspects, Judicial decisions, State governments, Municipal water, Cities, Industrial wastes, Mine acids, Sewage effluents, Sewage treatment, Water pollution effects, Chemical wastes, Water pollution treatment, Water quality control, Water quality, Water purification, Stream improvement.

The pollution of any one stream will consist of a varying combination of three basic types of pollution: physical pollution, chemical pollution, and bacterial pollution. Mere legal prohibition of pollution is not enough; the law must require treatment of pollutants before they enter streams. Common-law abatement measures have failed primarily because, unless the public has acquired rights for water supply or unless there is a statute involved, pollution is an injury of which only riparian owners may complain. Equity enforcement is also limited in that, by balancing the interests of the parties, the benefit to the plaintiff of abatement may be found disproportionate to the injury to the defendant's operations or interests. The public, acting through elected officials, stands a greater chance of obtaining equity enforcement than an individual, but there has been a failure to seek such enforcement. Not only have municipalities been lax in seeking protection from pollution, but they have themselves contributed a major share of contamination in the form of raw sewage. (Marsee-Florida)
W70-00924

STATUTORY STREAM POLLUTION CONTROL,
Seymour C. Wagner.
U Pa L Rev, Vol 100, No 2, p 230-236, Nov 1951.

Descriptors: *Pennsylvania, *Pollution abatement, *Water pollution control, *Acid mine water, Water pollution sources, Coal mine wastes, Legislation, Legal aspects, Judicial decisions, State governments, Industrial wastes, Mine acids, Pollutants, Sewage effluents, Sewage treatment, Water pollution effects, Chemical wastes, Municipal wastes, Water pollution treatment, Water quality control, Water quality, Stream improvement, Water purification.

The case of Pennsylvania Coal Co v Sanderson, 6 Atl 453 (1886), involved water pollution by the discharge of acid mine drainage. In denying relief for such injury, the case undoubtedly discouraged proponents of clean streams. The effect was to retard pollution abatement progress in all types of pollution situations; however, the case is doubtful authority in any field other than acid mine drainage. The inadequacy of common-law enforcement in preserving clean streams has led all but three states to adopt some sort of general statutory control to prevent pollution. While these statutes in general merely re-affirm common-law rights and obligations, they do create new methods of enforcement. Early statutory regulation of pollution in Pennsylvania was limited to the problem of sewage and contained many exceptions, including industrial wastes. The current statute also contains a general prohibition against the discharge of sewage; however, the Sanitary Water Board has been lax in its enforcement and interpretation. Current statutes concerning industrial wastes are more forceful, and the power of the Sanitary Water Board is not so all-inclusive. The greatest unsolved pollution problem today is that of mine drainage. (Marsee-Florida)
W70-00925

STATUTORY STREAM POLLUTION CONTROL,
Seymour C. Wagner.
U Pa L Rev, Vol 100, No 2, p 236-241, Nov 1951.

Descriptors: *Pennsylvania, *Pollution abatement, *Water pollution control, *Economic feasibility, Water pollution sources, Coal mine wastes, Legislation, Legal aspects, Judicial decisions, State governments, Federal government, Industrial wastes, Pollutants, Sewage effluents, Sewage treatment, Water pollution effects, Chemical wastes, Municipal wastes, Water pollution treatment, Water quality control, Water quality, Stream improvement.

Since the very remedies which proved ineffective at common law and equity are incorporated into the present water pollution act, the basis of the clean stream program in Pennsylvania must be the efficient employment of an administrative program. Just as common-law enforcement was lax, so a statutory program will fail unless efficiently implemented. Because rivers frequently constitute or cross state boundaries, interstate and federal enforcement action is needed. There is a growing tendency toward interstate agreements, and the federal government has recently taken an active interest in river pollution control. The most publicized aspect of the clean streams program in Pennsylvania has been the restoration of the Schuylkill River; however, the major economic problem lies not in reclamation but in financing the complex facilities needed to prevent untreated wastes from reaching rivers. Numerous financial burdens and problems must be faced, especially by municipalities, in establishing such systems. In the case of industry, state and federal aid is virtually non-existent. Water pollution control boards must determine which interests have valid claims and call for legislative and judicial aid where needed. (Marsee-Florida)
W70-00926

WATER POLLUTION CONTROL AND ABATEMENT (BOOK REVIEW); CONTROLLING POLLUTION: THE ECONOMICS OF A CLEANER AMERICA (BOOK REVIEW),
Birch Bayh.
Notre Dame Lawyer, Vol 43, No 5, p 796-798, June 1968. 3 p, 2 ref.

Descriptors: *Air pollution, *Water pollution, *Pollution abatement, *Water pollution control, Water pollution effects, Water pollution sources, Water pollution treatment, Air pollution effects, Pollutant identification, Abatement, Air environment, Pollutants, Public health, Water allocation (Policy), Water resources, Water quality, Standards, Water, Economic feasibility, Economic impact, Economics, Benefits, Costs, Cost-benefit theory.
Identifiers: Book reviews.

Water Pollution Control and Abatement, edited by Ted L. Willrich and N. William Hines, advocates and has as its main thrust the premise that pollution control is a fundamentally local matter that requires effective interrelationship of three factors: (1) a sincere state commitment to clean waters mainfested in a workable regulatory scheme; (2) knowledge and dedication on the part of state officials administering control programs; and (3) public understanding of the nature of the pollution problem and public support of control efforts. The book is a collection of essays. Controlling Pollution: The Economics of a Cleaner America, edited by Marshall I. Goldman, is a more specialized analysis concentrating primarily upon theoretical and practical problems faced by those who wish to approach solutions within the framework of costs and benefits. The underlying question is how an affluent society such as our own can best eliminate or control the serious consequences of pollutants. Writers of both books agree that the fundamental question of water quality control is whether a democratic, highly developed political system can discover and implement a formula which will allocate air and water resources equitably. (Marsee-Florida)
W70-00933

FISH POISONING; POISONING WATER SUPPLY.

Miss Code Ann secs 2326, 2328 (1956).

Descriptors: *Mississippi, *Poisons, *Public health, *Fish conservation, Mortality, Fish, Fishkill, Legislation, Reservoirs, Wells, Springs, Wildlife conservation, Fish management, Wildlife management, Water supply, Hazards, Fish toxins.

The use of any substance calculated and intended to stupefy or destroy fish shall be punishable as a misdemeanor. Any person who shall willfully poison any well, spring, or reservoir of water shall, upon conviction, be punished by imprisonment in the penitentiary not exceeding ten years. (Schram-Florida)
W70-00949

PAT HARRISON WATERWAY DISTRICT.
Miss Code Ann secs 5956-171 thru 5956-175, 5956-180, 5956-182 thru 5956-186, 5956-189 (Supp 1968).

Descriptors: *Mississippi, *Water districts, *Water policy, *Water conservation, Legislation, Construction, Irrigation water, Industrial water, Municipal water, Domestic water, Agriculture, Flood control, Pollution abatement, Taxes, Tax rate, Condemnation, Easements, Operating costs, Recreation, Right-of-way, Surface waters, Overflow, Fish conservation, Wildlife conservation, Water supply.

Authority is given to organize the Pat Harrison Waterway District to insure an adequate flood control program, provide a sufficient sanitary water supply, promote the balanced economic development of the state, and to aid in forest conservation, irrigation, and pollution abatement. All powers of the District are to be exercised by a Board of Directors. Procedures for creating the District through petitions, appointment of the directors, and organization of the Board are outlined. An extensive list of powers are granted to the District. Among these are the right to: (1) acquire land by purchase or condemnation; (2) overflow public lands; (3) impound surface or overflow water by constructing dams or reservoirs; (4) relocate highways, utilities, and railroads; and (5) develop plans and work with any federal or state agency. A series of limitations to the District's authority is included. The right to borrow money and issue bonds for the repayment thereof is granted. Taxing procedures are outlined and a special tax levy is provided for. Additionally, the Board of Directors is empowered to adopt all reasonable regulations to maintain sanitary water conditions, prevent waste, and regulate recreation. (Schram-Florida)
W70-00958

PAT HARRISON WATERWAY DISTRICT.
Miss Code Ann secs 5956-171 thru 5956-175 (Supp 1968).

Descriptors: *Mississippi, *Water districts, *Water policy, *Water conservation, Irrigation water, Industrial water, Municipal water, Domestic water, Recreation, Agriculture, Flood control, Pollution abatement, Water supply, Surface waters, Overflow, Forest management, Legislation, Optimum development plans, Water pollution, Construction.

Authority is given or organize the Pat Harrison Waterway District to conserve, utilize, develop, and regulate the overflow and surface waters so that their full beneficial use may be realized. This is deemed necessary to insure an adequate flood control program, provide a sufficient sanitary water supply, promote the balanced economic development of the state, and to aid in forest conservation, irrigation, and pollution abatement. The overflow waters for domestic, municipal, commercial, industrial, agricultural, and recreational uses are for the general welfare of the people of the state. All powers of the district shall be exercised by a Board of Directors. Provisions for the appointment of these directors, their compensation, term of office, and organization are detailed. The procedure for creation of the district through petitions is outlined. Hearings on such petitions and notice requirements are also dealt with. (Schram-Florida)
W70-00959

PAT HARRISON WATERWAY DISTRICT.
Miss Code Ann secs 5956-180, 5956-182 thru 5956-186, 5956-189 (Supp 1968).

Descriptors: *Mississippi, *Water districts, *Tax rate, *Water conservation, Fish conservation, Wildlife conservation, Taxes, Legislation, Assessments, Surface waters, Overflow, Water pollution, Pollution abatement, Condemnation, Right-of-way, Construction, Operating costs, Dams, Canals, Reservoirs, Recreation.

The powers of the district, through its Board of Directors, include the right to: (1) develop plans with any federal or state agency for public works; (2) impound overflow and surface water by constructing dams, reservoirs, or plants; (3) acquire by condemnation any needed property; (4) relocate highways, railroads, or any utility lines; (5) overflow any public lands; (6) construct any needed facility; (7) borrow money and issue bonds; (8) fix and collect charges for any services furnished; and (9) accept grants and exercise all other powers inherent in a corporate body. The power of taking land by purchase or condemnation is qualified, and the rights in such land which can be utilized are detailed. The district is authorized to establish parks and provide for fish and wildlife conservation. The Board of Directors has the power to adopt all reasonable regulations to maintain sanitary water conditions, prevent waste, and regulate recreation. Each county which is a member shall pay two mills of all ad valorem taxes due to the state to the district. A special tax levy, with bonds payable from ad valorem taxation, is provided. (Schram-Florida)
W70-00960

LOWER YAZOO RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00964

LOWER YAZOO RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00965

LOWER YAZOO RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00966

VILLAGE WATER SUPPLY INVESTIGATION, TERRITORY OF PAPUA AND NEW GUINEA,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
For primary bibliographic entry see Field 03B.
W70-00991

MODIFIED FILTER MEDIA FROM REMOVAL OF WATER POLLUTANTS,
For primary bibliographic entry see Field 05D.
W70-01027

STREAM REAERATION USING MOLECULAR OXYGEN,
H. R. Amberg.
Water Research, Vol 2, No 1, p 42-43, Jan 1968.

Descriptors: *Reaeration, *Dissolved oxygen, *Streams, Waste treatment, Oxygen sag, Diffusion, Water pollution treatment, Turbulence, Mixing, Dispersion, Pacific Northwest U. S.
Identifiers: *Stream reaeration, Molecular oxygen.

Drought flows and high water temperatures are usually associated with low dissolved oxygen levels in streams. An engineering method of stream reaeration using molecular oxygen instead of air is discussed as an economical alternative to conventional waste treatment. The solubility of molecular oxygen is 500% more than oxygen in equilibrium with air. The experimental work was conducted in a stream in the Pacific Northwest by using a power turbine. The oxygen was introduced at locations with relatively high dissolved oxygen concentration. In subsequent experiments, the molecular oxygen was introduced by using diffusers placed on the river bottom. It is possible to introduce large amounts of dissolved oxygen by using this method. Oxygen introduction is not limited, however, to the positions of the stream with high dissolved oxygen deficit, but may be located a reasonable distance upstream of the area in which it is needed. (Carstea-USGS)
W70-01028

COMPREHENSIVE WATER RESOURCES STUDIES ON THE ARA VALLEY AREA, JAPAN,
Akinori Sugiki.
Water Research, Vol 2, No 1, p 16-20, Jan 1968. 1 fig, 3 tab.

Descriptors: *Water resources development, *Water pollution control, Water pollution sources, Water demand, Water supply, Water management (Applied), Water conservation, Water resources, Water quality control.
Identifiers: *Ara Valley (Japan).

A system to control water pollution for the Ara Valley, Japan is discussed. The area is very heavily populated and industrialized. Industrial and domestic sources of water pollution are estimated. Pollution loads will increase 7 to 8 times compared with the present load if the pollution is not controlled. The water demand for industrial and domestic uses was estimated to be about 48 million tons per day. Food, pulp, paper, and chemical industries should be forbidden in the area, whereas clothing industry, saw-mill and printing should be developed. These and other restrictions could reduce the estimated pollution load by 40%. Further research dealing with pollution load, techniques for pollution control and water consumption was recommended. (Carstea-USGS)
W70-01034

APPROACH TO DETERMINE THE MINIMUM ALLOWABLE FLOW IN THE TISZA RIVER, HUNGARY,
Bela Hock.
Water Research, Vol 2, No 1, p 13-16, Jan 1968. 2 fig, 2 tab.

Descriptors: *Water quality control, *Flow augmentation, *Oxygen requirements, River flow, Low-flow augmentation, Reservoir storage, Dam construction.
Identifiers: *Tisza River (Hungary), Water quality prediction.

The effects on water quality of a dam construction in the Tisza River, Hungary are predicted by determining the relationships between stream flow and water quality. Experiments were conducted between 1960 and 1965 to establish specific relationships between oxygen demand and stream flow in the Tisza River and its tributaries. The quality of water stored in the reservoirs of Tisza River Barrage No. II was slightly improved. The minimum water flow released from the reservoir was calculated so that the oxygen demand in the river should not exceed 10 mg/l. Two assumptions were made in this calculation: (1) the quality of water discharge from the reservoir was identical to that of incoming water; (2) the rate of organic matter decomposition was the same as in 1960. (Carstea-USGS)
W70-01035

ON THE DIFFUSION PHENOMENA IN BOUNDARY LAYERS OF TURBULENT FLOW AND ITS INFLUENCE ON THE COURSE OF THE SELF-PURIFICATION OF SMALL STREAMS,
For primary bibliographic entry see Field 05C.
W70-01037

THE WATER QUALITY PROTECTION PLAN. EFFICIENT MEANS TO ASSURE RATIONAL USE IN HYDROGRAPHIC BASINS (FRENCH),
For primary bibliographic entry see Field 05A.
W70-01038

FINAL REPORT TO THE AMERICAN SOCIETY OF CIVIL ENGINEERS ON TASK 7 AND TASK 9 OF THE COMBINED SEWER SEPARATION PROJECT,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08A.
W70-01043

DEVELOP AND FIELD TEST METHOD OF INSTALLING PRESSURE CONDUITS IN COMBINED SEWERS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08A.
W70-01044

ANALYTICAL STUDIES OF TURBULENT FRICTION IN ANNULAR CONDUITS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01045

TURBULENT FRICTION IN ECCENTRIC ANNULAR CONDUITS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01046

RELATIONSHIP OF SEWAGE CHARACTERISTICS TO CARRYING VELOCITY FOR PRESSURE SEWERS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01047

ADVANCED DEVELOPMENT OF HOUSEHOLD PUMP-STORAGE-GRINDER UNIT (TASK 6),
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08C.
W70-01048

LONG-TERM OPERATION OF WASTEWATER OBSERVATION STATIONS (TASK 2),
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01049

REPORT ON PRESSURE SEWERAGE SYSTEM, SUMMER STREET SEPARATION STUDY AREA, BOSTON, MASSACHUSETTS,
American Society of Civil Engineers, New York; and Camp, Dresser and McKee, Boston, Mass.
For primary bibliographic entry see Field 08A.
W70-01051

COMBINED SEWER SEPARATION PROJECT, REPORT ON MILLWAUKEE STUDY AREA.
American Society of Civil Engineers, New York; Greeley and Hansen, Chicago, Ill.
For primary bibliographic entry see Field 08A.
W70-01052

SEPARATION OF COMBINED WASTEWATER AND STORM DRAINAGE SYSTEMS, SAN FRANCISCO STUDY AREA.
Brown and Caldwell, San Francisco, Calif.
For primary bibliographic entry see Field 08A.
W70-01053

OUTLINE DESCRIPTION OF ASCE PROJECT ON 'SEPARATION OF SANITARY SEWAGE FROM COMBINED SYSTEMS OF SEWERAGE'.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08A.
W70-01054

SEWAGE FLOW VARIATIONS IN INDIVIDUAL HOMES,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01055

EXPERIENCE WITH GRINDING AND PUMPING OF SEWAGE FROM BUILDINGS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08C.
W70-01056

STUDY OF APPROXIMATE LENGTHS AND SIZES OF COMBINED SEWERS IN MAJOR METROPOLITAN CENTERS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08A.
W70-01057

PRESSURE TUBING FIELD INVESTIGATION,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08A.
W70-01058

HYDRAULICS OF A PRESSURIZED SEWERAGE SYSTEM AND USE OF CENTRIFUGAL PUMPS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08C.
W70-01059

MINIMUM TRANSPORT VELOCITY FOR PRESSURIZED SANITARY SEWERS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01060

DOMESTIC SEWAGE FLOW CRITERIA FOR EVALUATION OF PROJECT SCHEME TO ACTUAL COMBINED SEWER DRAINAGE AREAS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01061

PEAK FLOWS OF SEWAGE FROM INDIVIDUAL HOUSES,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01062

CONTROL TECHNIQUES FOR PRESSURIZED SEWERAGE SYSTEMS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08C.
W70-01064

NON-MECHANICAL CONSIDERATIONS INVOLVED IN IMPLEMENTING PRESSURIZED SEWERAGE SYSTEMS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08A.
W70-01065

SPECIAL REQUIREMENTS FOR A FULL SCALE FIELD DEMONSTRATION OF THE ASCE COMBINED SEWER SEPARATION PROJECT SCHEME,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08A.
W70-01066

ROUTING OF FLOWS IN SANITARY SEWERAGE SYSTEMS,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08A.
W70-01067

DILUTION OF WASTE EFFLUENTS IN WATERS (IN RUSSIAN),
I. D. Rodziller.
Nauchnyie doklady po voprosam samootchishchenia vodoyomov i smeshchenia stochnykh vod, p 25-38, Tallinn politecnic institute, Tallinn, ESSR, 1965.

Descriptors: *Water quality, *Waste dilution, Water pollution, Turbulence, Diffusion, Mass transfer, Stream pollution, Waste assimilative capacity, Water pollution effects, Mathematical models, Biochemical oxygen demand, Dissolved oxygen content, Water quality standards, Acidity.

A method of computation is presented which allows determination of (a) the distribution of Biochemical Oxygen Demand and Dissolved Oxygen below an effluent discharge into a stream including any number of effluent outfalls in both sides of the stream. The following equation was L (oi)= (L (o) to the P power) x (10 to the-Kpt power)+ A+ B for BOD concentration where L (o) to the P power is BOD of water upstream of effluent outfall, 'A' represents the sum of the effects of all effluent outfalls on the side where the main effluent outfall lies, and 'B' represents the same for the opposite side; (b) The distance below the effluent discharges where complete mixing takes place was also determined by a formula; and (c) Effects of acids and bases on water quality are discussed, and formulas are presented for calculation of pH, acidity and alkalinity. (Novotny-Vanderbilt)
W70-01084

STATEMENTS OF POLICY ON PUBLIC WATER SUPPLY MATTERS--AMERICAN WATER WORKS ASS'N PRINCIPLES OF NATIONAL WATER POLICY.
Amer Water Works Ass'n J, Vol 61, No 10, Part 2, p 22-26, Oct 1969. 5 p.

Descriptors: *Water pollution, *Water policy, *Water pollution control, *Water resources development, Pollution abatement, Water users, Water treatment, Water storage, Low flow, Low flow augmentation, Federal government, State governments, Coordination, Planning, Organizations, Recreation, Water quality, Regulation, Water sources.

The American Water Works Association recommends a sound water resources policy based on planning and careful management. The responsibility for assuring water quality rests with those persons returning wastes to our resources. All government levels must act together in programs of pollution control and abatement and water resources data accumulation. The federal government should support state and local water programs rather than pre-empt them, except in cases where economic and planning complexities are beyond local capacity. A single state agency should be established in each state to provide a unified and coordinated water resources policy. Local public water suppliers should continue planning, financing, and operating systems for public and industrial users. The Association recognizes that as an interim measure it may be necessary to release water from storage for low flow augmentation rather than provide the high degree of waste treatment otherwise required. The Association opposes legislation permitting the opening of domestic water supply reservoirs to recreational use and urges control over waste discharges and land use affecting water sources. (McDonough-Florida)
W70-01130

BASIC WATER USE DOCTRINES AND STATE WATER CONTROL AGENCIES.
For primary bibliographic entry see Field 04A.
W70-01131

THE FEDERAL GOVERNMENT AND AIR AND WATER POLLUTION,
Paul E. Bermingham.
Bus Lawyer, Vol 23, No 2, p 467-481, Jan 1968. 15 p, 68 ref.

Descriptors: *Federal government, *Water pollution, *Water pollution control, *Federal jurisdiction, Regulation, Pollutants, Water supply, Recreation, Water quality control, Rivers and Harbors Act, Navigation, Treaties, Interstate rivers, Navigable waters, Cities, Legislation, Administrative agencies, Pollution abatement, Judicial decisions, Legal aspects, State jurisdiction, Effluents, Watercourses (Legal), Water pollution effects, Water pollution sources, Water pollution treatment, Standards.
Identifiers: *Water criteria, *Coastal waters, Injunctions (Prohibitory).

The author indicates that there is a four-step approach to pollution control: (1) water criteria which is an expression of the effect of various concentrations of pollutants depending on the intended use of body of water; (2) water quality standards which prescribe pollutant levels that cannot legally be exceeded; (3) effluent standards which prescribe the maximum amount of a specified pollutant that can be discharged from individual sources during specified time periods into specified waterways; and (4) control requirements which

regulate pollutant treatment before discharge. The history of pollution and the control role of the federal government are traced via federal legislation from the Rivers and Harbors Act of 1899 to the Federal Water Pollution Control Act of 1956. The 1956 Act gave each state until 1967 to adopt water quality standards for interstate waters within its borders. If a state did not comply, the Department of the Interior set the standards. The author points out how the federal government has extended its jurisdiction in the area of pollution control through expanding definitions of such terms as 'navigable waters', 'interstate waters', and 'coastal waters.' The questions of the constitutionality of the Act and abatement proceedings under the Act are briefly discussed. (Keith-Florida)
W70-01136

OFFENSES AGAINST PROPERTY BY FORCE.
For primary bibliographic entry see Field 06E.
W70-01149

OBSTRUCTION AND POLLUTION OF WATERS.

Miss Code Ann secs 2414, 2415 (1956), sec 2415.5 (Supp 1968).

Descriptors: *Mississippi, *Water pollution, *Water pollution control, *Obstruction to flow, Pollution abatement, Impaired water quality, Pollutants, Public health, Riparian rights, Standards, Wastes, Water conservation, Legislation, Sewage, Industrial wastes, Municipal wastes, Sewage disposal, Sewerage, Water pollution sources, Fish, Navigable waters, Navigation.

Any person who unreasonably obstructs any navigable waters or pollutes any such waters rendering them less fit for drink or for sustaining fish shall be guilty of a misdemeanor punishable by not more than a fifty dollar fine and/or imprisonment for thirty days. This shall not be construed to prevent any municipality from constructing sewers that empty into any navigable stream whose length is twenty-five miles or more. The State Board of Health, when public health requires, may prevent such emptying of sewerage or require steps to correct any evil that may exist. It is unlawful for any creosoting plant or any sawmill to dump wastage into any running stream. Any violation shall be deemed a misdemeanor punishable by a fine of not less than twenty-five dollars and not more than one hundred dollars for each offense. Each day that this section is violated shall constitute a separate offense. It is a misdemeanor for anyone to push, fell, or cut trees in excess of six inches in diameter into a running stream when such trees will materially impede the flow of or navigation upon such stream. (Schram-Florida)
W70-01151

GENERAL PROVISIONS OF THE STATE WATER CONTROL LAW.
Va Code Ann secs 62.1-14, 62.1-16 thru 62.1-18 (1968).

Descriptors: *Virginia, *Water quality, *Water quality control, *Water pollution control. Legislation, Legal aspects, Water control, Water law, Fish reproduction, Aquatic life, Fish conservation, Pollution abatement, Water rights, Permits, Wastes, Sewage, Recreation, Public health, Shellfish, Administration, State governments, Administrative agencies.
Identifiers: *Pollution prevention, *Waste discharge, *Public water uses, Public policy, Penalties (Criminal).

It is the policy of the state and the purpose of this chapter to: 91) maintain or restore all state waters to a condition of quality that will permit all reasonale public uses and support the propagation and growth of all aquatic life; (2) safeguard the clean waters of the state from pollution; (3) prevent any increase in pollution; and (4) reduce existing pollution. No right to continue existing pollution in any state water will exist, nor will such right be or be deemed to have been acquired because of past or future pollution. The right and control of the state in and over all state waters is expressly reserved and reaffirmed. It is declared to be against public policy and a violation of this chapter for any owner who does not have a State Water Control Board certificate to discharge wastes or noxious or deleterious substances into state waters or to otherwise alter the physical, chemical, or biological properties of state waters so as to diminish the usefulness of such waters. This chapter is supplemental in nature and will not be construed to repeal existing law; the administration of existing pollution law will be in accord with the purposes of this chapter. (Keith-Florida)
W70-01169

POWERS AND DUTIES OF THE STATE WATER CONTROL BOARD.

Va Code Ann sec 62.1-27 (1968).

Descriptors: *Virginia, *Water quality control, *Water pollution control, *Water control, Legislation, Legal aspects, Administrative agencies, Water pollution, Regulation, Investigations, Pollution abatement, Water quality, Standards, Sewage, Industrial wastes, Permits, Fish, Water treatment, Pollutant identification, Damages, Operation and maintenance, Investigations.
Identifiers: *Pollution prevention.

The State Water Control Board has the duty and authority to (1) supervise the administration and enforcement of this chapter, and all standards, policies, regulations, and special orders promulgated thereunder; (2) study, investigate, and make recommendations concerning all state water pollution problems; (3) establish quality standards for waters in relation to the reasonable and necessary use thereof, and policies relating to pollution in keeping with the purposes of this chapter; (4) conduct scientific experiments, investigations, and research to discover economical and practical methods for preventing pollution; (5) issue certificates for the discharge of waste into state waters; (6) insure compliance with its certificates, standards, regulations, and special orders; (7) adopt administrative rules governing its procedure; (8) issue special orders to secure the control, abatement, and prevention of pollution; (9) adopt such regulations as it deems necessary to enforce the general pollution abatement program of the Board; (10) investigate any large scale killing of fish believed or known to have resulted from pollution, bringing a civil action against persons wilfully or negligently responsible for such killings; and (11) administer programs of financial assistance for state political subdivisions for the planning, construction, operation, and maintenance of water quality control facilities. (Keith-Florida)
W70-01170

REGULATION OF SEWAGE DISCHARGE.

Va Code Ann secs 62.1-31 thru 62.1-33 (1968).

Descriptors: *Virginia, *Sewage treatment, *Sewerage, *Sewage disposal, Sewers, Water pollution sources, Water pollution control, Waste disposal, Environmental sanitation, Sewage, Wastes, Governments, State governments, Legislation, Treatment, Administrative agencies, Cities, Regulation, Water quality control, Water pollution.

All sewerage systems and sewage treatment works are under the joint supervision of the State Department of Health and the State Water Control Board. The Department advises cities, towns, sanitary districts, and owners that intend to install sewage treatment works as to the appropriate type of treatment. Owners of treatment works from which sewage is discharged into state waters must furnish the Department, when requested by the Board, information regarding the operation of such facilities. Owners presently discharging sewage into state waters may apply to the Board to continue to do so; however, the present volume and strength of the sewage may not be increased. The Board may not authorize any sewage discharge which would result in the pollution of clean state waters. All new sewerage systems or sewage treatment works designed to serve more than four hundred persons, or which will extend or alter materially such existing systems, must be approved by the Board. (Marsee-Florida)
W70-01171

PENALTIES FOR POLLUTION AND POLLUTION FROM BOATS.
Va Code Ann secs 62.1-43 thru 62.1-44.1 (1968).

Descriptors: *Virginia, *Sewage disposal, *Waste disposal, *Water pollution control, Water pollution sources, Disposal, Environmental sanitation, Sewage, Wastes, Governments, State governments, Legislation, Administrative agencies, Regulation, Legal aspects, Boats, Navigable waters, Nonnavigable waters, Water quality control, Recreation wastes, Pollutants, Water pollution, Administration.

It is unlawful for any owner to cause pollution in state waters contrary to any special order adopted by the State Water Control Board. It is also unlawful to discharge sewage, industrial waste, or other wastes in violation of any condition contained in a sewage disposal certificate issued by the Board. Likewise unlawful is the failure or refusal to furnish information required by the Board. Penalties are herein provided. The Board promulgates regulations for the purpose of controlling the discharge of sewage and wastes from boats into navigable and non-navigable waters. In formulating such regulations, the Board consults with the State Department of Health, the Commission of Game and Inland Fisheries, and the Marine Resources Commission for the purpose of coordinating such rules. (Marsee-Florida)
W70-01172

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN.
Va Code Ann secs 62.1-64 thru 62.1-69 (1968).

Descriptors: *Virginia, *Interstate commissions, *Interstate compacts, *Water pollution control, Water pollution, Water quality, Water quality control, Water resources, Interstate, Interstate rivers, Maryland, Pennsylvania, West Virginia, District of Columbia, River basins, Administrative agencies, Legislation, Governments, State governments, Federal government, Leadership, Financing, Coordination, Abatement.

The governor is authorized and requested to execute, on behalf of Virginia, a compact with Maryland, West Virginia, Pennsylvania, and the District of Columbia for the creation of the Potomac Valley Conservancy District. The purpose of such District is the abatement of existing pollution and the control of future pollution in interstate streams. The compact includes provisions for: (1) the creation of the Interstate Commission on the Potomac River Basin; (2) the powers of the Interstate Commission; (3) the financing of the Interstate Commission; and (4) the effective date of the compact. The Potomac River Basin Commission of Virginia is created subject to the execution of the above compact, and the appointment, terms, and qualifications of members are prescribed. The Potomac River Basin Commission of Virginia acts with and as a unit of the Interstate Commission and performs duties as provided by the compact. (Marsee-Florida)
W70-01173

OHIO RIVER VALLEY WATER SANITATION COMMISSION.
Va Code Ann secs 62.1-70 thru 62.1-72 (1968).

Descriptors: *Virginia, *Interstate commissions, *Interstate compacts, *Water pollution control, Water pollution, Water quality, Water quality control, Water resources, Interstate, Interstate rivers, River basins, Administrative agencies, Legislation, Governments, State governments, Federal government, Leadership financing, Coordination, Abatement, Ohio River.

The governor is requested to execute on behalf of Virginia, the Ohio River Valley Sanitation Compact. The purpose of the Compact is to abate existing and control future water pollution in the waters of the Ohio River Valley Basin. The terms and form of the Compact are set forth including: (1) the creation of the Ohio River Valley Water Sanitation District; (2) the creation of the Ohio River Valley Water Sanitation Commission; (3) the composition of the Commission and the selection of commissioners; and (4) the powers and duties of the Commission. It is recognized that no single standard for the treatment of sewage or industrial wastes is applicable in all parts of the district; therefore, the guiding principle of this compact shall be that pollution within a signatory state shall not injuriously affect the various uses of interstate waters. All sewage and industrial wastes entering interstate waters must be treated to the extent necessary to maintain such waters in a sanitary condition at least equal to the condition of the interstate waters immediately above the confluence. The Commission shall recomment uniform water pollution legislation to the signatory states. (Marsee-Florida)
W70-01174

DREDGING SAND AND GRAVEL AND MISCELLANEOUS OFFENSES (WATER POLLUTION)
Va Code Ann secs 62.1-190 thru 62.1-196 (1968).

Descriptors: *Virginia, *Riparian rights, *Dredging, *Water pollution, Pollutants, Water conservation, Fouling, Sands, Gravels, Beaches, Streambeds, Ownership of beds, Navigable waters, Low water mark, Tidal water, High water mark, Oil, Oil wastes, Impaired water quality, Obstruction to flow, Public health, Water pollution sources, Federal government.
Identifiers: Injunctions (Prohibitory), Penalties (Criminal), Penalties (Civil), Dumping garbage.

Dredging of sand or gravel from any part of the fastland, beach, or bluff abutting any river, stream, or other waters within the jurisdiction of the state or from the beds thereof is prohibited. Any person or corporation violating these provisions is guilty of a misdemeanor. The owner of any such fastland, beach, bluff, or bed of stream on which such a deposit exists may obtain an injunction to prohibit such dredging and may recover treble damages for any material removed. These prohibitions do not apply to the owners of such deposits, their licensees, or licensees of the United States. It is unlawful to obstruct or contaminate state waters by dumping garbage or any other substance which may impair the lawful use or enjoyment of them. Any obstruction which exists for more than a week, except a lawfully constructed dam, is prohibited. Contamination or obstruction of certain areas is specifically prohibited. Oil may not be discharged upon or under the navigable tidal waters of the state. Persons renting boats are required to provide a life preserver for each passenger. (Schram-Florida)
W70-01181

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION.

R I Gen Laws Ann secs 46-16-1, 46-16-2 (1956).

Descriptors: *Rhode Island, *Interstate compacts, *Water pollution control, *New England Interstate WPS Compact, New England, Pollution abatement, Water quality control, Interstate, Interstate commissions, Interstate rivers, Water pollution treatment, Control, Industrial wastes, Standards, Administrative agencies, Financing, Costs, Cost allocation, Cost sharing, Sewage, Regulation.
Identifiers: *Interstate waters.

The Commission on Interstate Cooperation is directed to negotiate with Maine, New Hampshire, Vermont, Massachusetts, and Connecticut the New England Interstate Water Pollution Control Compact. The Compact is to abate existing and control future pollution in the interstate waters of the New England area. Toward this end the New England Interstate Water Pollution Control Commission is created. The membership of the Commission and the procedure for the selection of commissioners is herein set forth along with various powers and duties of the Commission. The Compact recognizes that no single standard of sewage and waste treatment and no single standard of quality of receiving waters is practical. The degree of treatment of sewage and industrial wastes should take into account the classification of the receiving waters according to present and proposed highest use. The Commission is to establish physical, chemical, and bacteriological standards of water quality satisfactory for various classifications of use. Each state will prepare a classification of its interstate waters, and the Commission may make such changes in definitions, classifications, or standards as are necessary for uniformity. Distribution of costs among the signatory states is provided. (Marsee-Florida)
W70-01191

OXYGEN MANAGEMENT AND ARTIFICIAL REAERATION IN THE AREA OF BALDENEY LAKE AND THE LOWER RUHR RIVER (IN GERMAN),
Ruhrverband, Essen (West Germany).
Klaus R. Imhoff.
English summary. Das Gas- und Wasserfach, 109 Jahrg (1968), Heft 34, Seite 936-941 (Wasser-Abwasser).

Descriptors: *Pollution control, *Aeration, *Optimization, Water pollution, Dissolved oxygen, Biochemical oxygen demand, Costs, Oxygenation.
Identifiers: *Instream aeration, Diffuser aerator, Mechanical Aerator, Hydraulic turbine aerator.

The Ruhr River in Germany has presented a major pollution control problem for a long time. Although only a small river, the equivalent of sewage from over 2 million population comes through the central area near the city of Essen. In addition to very strict control of effluents by waste treatment plants, the pollution control agency, the Ruhrverband, has applied instream aeration as a supplemental means. Three aeration methods have been used--by introducing air into hydraulic turbines, by diffusers (bubbling from submerged orifices), and by mechanical aerators. Technical analysis allows an economic comparison as follows. In order to remove organic pollution of one population equivalent, at times of low flow, the cost would amount to 0.81 DM for a mechanical aerator, and 0.22 DM with the turbine aerator, as compared to 4.0 DM for expansion of the treatment plant to achieve the same result. Other figures show the diffuser as much less economic than the mechanical aerator, though part of the extra cost is due to certain special circumstances. This result is in accord with recent American findings that instream aeration is an economical means in severe pollution situations. (Whipple-Rutgers)
W70-01224

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

APPLICATION OF DYNAMIC PROGRAMMING TO THE CONTROL OF WATER RESOURCES SYSTEMS,
Stanford Research Inst., Menlo Park, Calif.
Robert E. Larson, and William G. Keckler.
IFAC, Haifa Symp, Comput Contr Nat Resources Publ Util, p 1-52, Sept 1967. 52 p, 11 fig, 6 tab, 12 ref.

Descriptors: *Dynamic programming, *Water resources development, *Optimization, *Planning, Stochastic processes, Reservoir operation, Approximation method, Hydroelectric power, Irrigation efficiency, Investment, Water demand, Water storage, Control systems.

The applicability of dynamic programming techniques for solving optimization problems that occur in the operation and planning of a water system was examined. Several specialized dynamic programming techniques were introduced. These included forward dynamic programming, successive approximations dynamic programming for stochastic control, iteration in policy space and state increment dynamic programming. Four examples were presented and discussed. Short term optimization of a two reservoir system was solved with the forward dynamic process, short term optimization of a four reservoir system was treated by successive approximations; optimum operation over a year, with streamflows treated a stochastic variables, was determined by iteration in policy space, and optimum long term planning of system additions was treated by forward dynamic programming. Dynamic programming was found to be suitable for solving a wide range of water resource problems extending from hourly control of a system involving hydroelectric power, water storage and irrigation, to a long range optimum investment planning. (Thiuri-Cornell)
W70-00903

VALUATION OF A GROUNDWATER SUPPLY FOR MANAGEMENT AND DEVELOPMENT,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W70-00904

STORAGE YIELD: EXTENDING THE SEQUENT PEAK ALGORITHM TO MULTIPLE RESERVOIRS,
Water Resources Engineers, Inc., Springfield, Va.
G. K. Young, and C. D. Puentes.
Work sponsored by Texas Water Develop Board and Dept of Interior , (OWRR). Water Resources Res, Vol 5, No 5, p 1110-1114, Oct 1969. 5 p, 2 fig, 5 ref. OWRR Grant No 14-01-0001-1975.

Descriptors: *Mathematical studies, *Reservoir storage, *Reservoir design, *Reservoir operation, Reservoir yield, Computer programs, Streamflow, Reservoir construction, Systems analysis.
Identifiers: *Sequential peak algorithm, Multiple-reservoir systems.

The sequent peak algorithm is extended to find volume requirements as a function of time. These requirements are helpful in determining reservoir construction timing in multiple-reservoir systems. The principal variable used in the algorithm characterizes a reservoir storage history which is unfounded by volume limits. (Knapp-USGS)
W70-01000

STOCHASTIC METHODS FOR ANALYZING RIVER BASIN SYSTEMS,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
Daniel P. Loucks.
Available from the Clearinghouse as PB-187 686, $3.00 in paper copy, $0.65 in microfiche. Research Project Technical Completion Report, Water Resources and Marine Sciences Center, Aug, 1969. 306 p, 39 ref. OWRR Project C-1034.

Descriptors: *Stochastic processes, *Analytical techniques, *River basins, *Linear programming, *Dynamic programming, *Reservoir operation, Simulation analysis, Optimization, Delaware River, Water quality control, Water resources development, Multi-purpose reservoirs.
Identifiers: Targets, Operating policies.

A variety of stochastic linear, nonlinear and dynamic programming methods are presented for the preliminary selection of alternative water

resource system designs and operating policies. Emphasized is the influence of hydrologic risk on water resource planning. The optimism inherent in the results of most river basin system analyses that do not explicitly consider at least some of the variability of streamflow is illustrated through numerous applications of the models to both simple and complex examples. Three types of stochastic models are compared for defining sequential operating policies for a multipurpose reservoir. In situations where capacities and targets are not variables, dynamic programming is shown to be a very efficient method for defining operating policies. Water quality (DO, BOD) control by wastewater treatment and flow augmentation is examined from a regional multi-objective viewpoint. A detailed optimization-simulation study of the Delaware River basin illustrates the efficiency of both deterministic and stochastic optimization models for use in the preliminary selection of design and operating alternatives for further analysis by simulation.
W70-01085

GENERAL SYSTEMS APPROACH TO GROUND-WATER PROBLEMS,
Arizona, Tucson.
For primary bibliographic entry see Field 02F.
W70-01123

6B. Evaluation Process

EVALUATION OF BENEFITS OF A FLOOD WARNING SYSTEM,
Carnegie-Mellon Univ., Pittsburgh, Pa.; Systems Planning Associates, Pittsburgh, Pa.; and Weather Bureau, Pittsburgh, Pa.
H. J. Day, G. Bugliarello, P. H. P. Ho, and V. T. Houghton.
Water Resources Res, Vol 5, No 5, p 937-946, Oct 1969. 10 p 7 fig, 3 tab, 15 ref.

Descriptors: *Flood protection, *Non-structural alternatives, *Cost-benefit analysis, *Warning systems, Flood damage, Cost analysis, Flood plain zoning, Flood proofing.
Identifiers: Flood warning systems.

Benefits due to a flood warning system are estimated by using individual structure stage damage curves for several warning periods. Typical stage damage warning time data for residence, a grocery supermarket, and a railroad switchyard serve as examples for benefit evaluation. The application of these concepts to 650 residences involved in the 1959 flood at Meadville, Pennsylvania, indicated that reducible damages represent approximately one-third of the total residential damage. Both evacuation and temporary floodproofing, two non-structural alternatives used frequently, may be evaluated more explicitly by this method. (Knapp-USGS)
W70-00838

PRIVATE WATER RIGHTS IN FRANCE AND IN THE EASTERN UNITED STATES,
Ludwik A. Teclaff.
Am J Comp L, Vol 11, No 4, p 560-573, Autumn 1962. 14 p, 40 ref.

Descriptors: *Riparian rights, *Prior appropriation, *Reasonable use, *Legal aspects, Surface waters, Streams, Civil law, Navigable waters, Ownership of beds, Riparian land, Water law, Industrial water, History, Public rights, Non-navigable waters, Foreign waters, Underground streams, Subsurface waters, Water rights, Competing uses, Foreign countries, Water demand, Water supply.
Identifiers: *Common law, Foreign water law, Eastern United States.

The history of water law and the development of the three distinct theories of riparian rights, prior appropriation, and administrative appropriation are briefly reviewed. Despite differing legal heritages, both France and the Eastern United States adopted the riparian theory. Both recognize different forms of water - stream, underground, and surface - and attach specific rights to each. These areas are discussed and water rights in respect to each area are compared. The discussion of streams comprehensively covers: (1) public streams; (2) non-public streams; (3) riparian land; (4) riparian rights; (5) industrial uses; (6) police power of the state; and (7) other characteristics of riparian rights. Similarities and differences in these areas are illustrated through reference to both statutory and case law. The author concludes that the quantity of available water was responsible for adherence to the riparian theory, and an equitable working of the system was provided through checks and balances involving reasonable use. Imminent water shortages, brought about by industrial use, seem to require more administrative control in each country. (Schram-Florida)
W70-00916

PRIVATE WATER RIGHTS IN FRANCE AND IN THE EASTERN UNITED STATES,
Ludwik A. Teclaff.
Am J Comp L, Vol 11, No 4, p 560-564, Autumn 1962. 5 p, 15 ref.

Descriptors: *Riparian rights, *Prior appropriation, *Navigable waters, *Non-navigable waters, Ownership of beds, Streams, Civil law, History, Public rights, Foreign waters, Foreign countries, Legal aspects, Water law, Beds, Stream beds, Administration, Interstate rivers, Underground Streams, Surface waters.
Identifiers: *Common law, Foreign water law, France.

By the 19th century, water law had begun to crystallize into three distinct types: (a) riparian rights, limiting the right of water use to the owners of adjacent lands; (b) prior appropriation, giving this right to the first user; and (c) administrative apportionment, placing the disposition of water in the hands of the government. None of these doctrines is peculiar to either common law or to civil law. The most important factor in adopting one type of law is the quantity of water available. Both France and the Eastern United States adhere to the riparian rights doctrine. Major changes in French water law have been made by statutes. In the United States, water law has developed primarily through judicial decisions. Both France and the United States use navigability to determine whether streams are public or subject to private ownership. In France, public ownership is determined today by administrative enumeration while American courts generally still use the navigability test. Riparian owners in France have the same right to public streams as the general public, but in the United States such rights are only subject to the rights of the public and of navigation. Under both systems ownership of beds of non-public streams is accorded to the riparians. (Schram-Florida)
W70-00917

PRIVATE WATER RIGHTS IN FRANCE AND IN THE EASTERN UNITED STATES,
Ludwik A. Teclaff.
Am J Comp L, Vol 11, No 4, p 564-569, Autumn 1962. 6 p, 17 ref.

Descriptors: *Riparian rights, *Riparian land, *Natural flow doctrine, *Reasonable use, Industrial water, Hydroelectric power, Remedies, Relative rights, Obstruction to flow, Mill dams, History, Public rights, Non-navigable waters, Navigable waters, Competing uses, Legal aspects, Water law, Ownership of beds, Usufructuary right.

The water of non-public streams is not subject to ownership, hence owners of riparian land have only limited rights to it. In both countries, land must touch the stream at some point to be classified as riparian. In other respects, the French and American systems differ considerably in their definition of riparian land. In relation to riparian rights, American jurisdictions utilize either the natural flow doctrine or reasonable use theory. The French system resembles more the doctrine of reasonable use since no hierarchy of uses is established. French and American riparian rights differ in the treatment of non-navigable streams as sources of power. In France, the administration may award licenses to non-riparians on payment of compensation to dispossessed riparian owners. Riparian rights in both countries are limited by the police power of the state. In France this is vested in the administration. In the United States, the Federal Constitution poses the problem of states limiting property rights for the public welfare. It appears that the states have ample latitude in this field. Riparian rights are protected in France by possessory action and in the United States by action for damages and injunction. (Schram-Florida)
W70-00918

PRIVATE WATER RIGHTS IN FRANCE AND IN THE EASTERN UNITED STATES,
Ludwik A. Teclaff.
Am J Comp L, Vol 11, No 4, p 569-573, Autumn 1962. 5 p, 8 ref.

Descriptors: *Underground streams, *Percolating water, *Surface waters, *Water rights, Confined water, Riparian rights, Subsurface waters, Beneficial use, Domestic water, Industrial water, Irrigation water, Prior appropriation, Reasonable use, Natural flow doctrine, Remedies, Prescriptive rights, Riparian waters, Water law.
Identifiers: *Common law.

French law makes no distinction between the various forms of underground water. In the United States underground streams flowing in a definite channel are distinguished from the various forms of percolating water. In the United States the reasonable use theory is replacing the common-law notion that the owner of the overlying land had full ownership of the underground water. The French law is similar to the laws of those states that follow the common-law rules, mitigated by the exclusion of malicious uses. Both systems give the landowner full ownership of surface waters. In the United States, such water is treated as part of the land, whereas in France it becomes an object of ownership only upon capture. French water law and its counterpart in the eastern United States developed in regions where water is comparatively abundant. As long as the water was used mainly for domestic purposes and for irrigation, the riparian system worked well. But it proved inadequate when industrial uses of water began. In both countries development seems to point in the same direction--toward more administrative control. (Schram-Florida)
W70-00919

NOTES ON WATER WORKS LAW SECOND INSTALLMENT - IRRIGATION AND RIPARIAN RIGHTS,
John H. Murdock, Jr.
Water and Sewage Wks, Vol 102, No 1, p 12-18, Jan 1955. 7 p.

Descriptors: *Irrigation, *Riparian rights, *Legal aspects, *Reasonable use, Alteration of flow, Artificial use, Natural use, Competing uses, Natural flow doctrine, Obstruction to flow, Relative rights, Remedies, Riparian land, Riparian waters, Usufructuary right, Water law, Water utilization, Judicial decisions, Streams, Rivers, Irrigation water, Water rights, Water supply.

Irrigation may cause a threat to public water supplies. The downstream riparian owner has a right to the unimpeded flow of the stream, while the upland riparian owner has the right to reasonable use of the water. Court decisions have recognized the right to use the water for irrigation if the use is not unreasonable. The criteria is whether the water flowing to the lower owner's land has been materially diminished. Several cases have held that where the water supply is not sufficient to provide for competing natural riparian uses and also irrigation,

then irrigation would be an unreasonable use. The common law rule is that water may not be diverted to irrigate non-riparian land because this is not a riparian right. The size of the stream involved will be very relevant to the issue of whether irrigation is a reasonable use. Once a right to irrigate is established as reasonable it may only be stopped by the acquisition of the riparian right itself. Eminent domain may be used to acquire such a right if it is required for the public water supply. Unreasonable diversions may be enjoined. (Darragh-Florida)
W70-00920

REAL PROPERTY--RIPARIAN GRANTS--LEGISLATIVE LIMITATIONS ON EXTENT OF GRANT.
Rutgers L Rev, Vol 10, No 4, p 738-741, Summer 1956. 4 p.

Descriptors: *New Jersey, *Tidal waters, *Administrative agencies, *Ownership of beds, Bulkhead line, Legislation, Judicial decisions, Bays, Riparian land, Land tenure, Equitable apportionment, Legal aspects, Water zoning, Administration, Competing uses, Water allocation (Policy), Regulation, Zoning, Beds, Land, Landfills, Land forming, Piers, Bulkheads, Structures.
Identifiers: *Submerged Land Grants.

Bailey v Driscoll, 19 NJ 363, 117 A2d 165 (1955), which involved the grant of lands formerly under Barnegat Bay, presents the problem of determining the limitations placed by the New Jersey legislature upon the extent of such grants. Enactments concerning riparian grants of submerged and formerly submerged lands are in a confused state because of such grants' piecemeal enactment. One series of acts limits grants to 'exterior lines', apparently meaning bulkhead or pier lines beyond which it is unlawful to erect and maintain any structure. Another series of acts, by 'exterior lines', appears to mean a demarcation line beyond which there can be no obstruction of navigation. Also, by virtue of these acts, the Council of the Division of Planning and Development is simultaneously limited to exterior lines in granting lands and given the power to establish such lines. The Supreme Court properly held in the instant case that the Council could grant lands to the extent of the established exterior lines. How far outward into the water exterior lines may be established was not decided, although it appears from the statutes that such lines shall not interfere with public navigation. (Marsee-Florida)
W70-00927

GOVERNMENTAL TECHNIQUES FOR THE CONSERVATION AND UTILIZATION OF WATER RESOURCES: AN ANALYSIS AND PROPOSAL.

Yale L J, Vol 56, No 2, p 276-303, Jan 1947. 28 p, 125 ref.

Descriptors: *Water resources development, *Water conservation, Water utilization, *Federal government, Federal-state water rights conflicts, Watersheds (Basins), State governments, Interstate commissions, Interstate compacts, Interstate rivers, River basins, Drainage, Watershed management, Port Authority of New York, Tennessee Valley Authority Project, Administrative agencies, Legislation, Water control.
Identifiers: Regional drainage projects.

The scarcity of water in the arid and semi-arid regions of the United States, coupled with the interstate character of drainage basin problems, has produced a demand for effective federal-state water control and regional development. Federal administrative techniques have led to the dispersal of water problems among different departments leading to jurisdictional disputes and duplication of functions. Interstate compacts are also inhibited by jurisdictional disputes, state constitutional limitations, lack of funding, and lack of coercive authority. The success of the Tennessee Valley Authority and the Port of New York Authority illustrates that proper delegation of federal and state power can be effectively merged. The nation requires a national corporation created by Congress and the negotiation of interstate compacts delegating important state powers over water resources to the corporation. The corporation will operate on a regional basis cooperating with and coordinating federal and state authority to develop an effective drainage basin program. (McDonough-Florida)
W70-00934

GOVERNMENTAL TECHNIQUES FOR THE CONSERVATION AND UTILIZATION OF WATER RESOURCES: AN ANALYSIS AND PROPOSAL.

Yale L J, Vol 56, No 2, p 276-288, Jan 1947.

Descriptors: *Water resources development, *Watersheds (Basins), *River basin development, *Administrative agencies, Tennessee Valley Authority Project, Interstate rivers, Interstate commissions, State jurisdiction, Federal jurisdiction, Legislation, Watershed management, Water rights, Water utilization, Regulation, Federal government.
Identifiers: Regional drainage projects.

The effective regulation and development of a river basin area is inhibited by the interstate character of the basin drainage problem. Traditionally the Supreme Court has acted as the arbiter of interstate water disputes on a case by case basis. The federal government utilizes the war power, treaty power, and the commerce clause for national programs for navigation improvement, flood control, and power production. Administration of national policy is further divided among the departments of Agriculture, Interior, State, and Treasury in divergent water control activities. The absence of an organizational pattern of nation-wide machinery for coordinating plans has led to duplication of functions and jurisdictional disputes within departments. One method to escape this federal compartmentalizing of responsibility has been the Congressional creation of regional valley authorities. The success of the Tennessee Valley Authority as a single governmental agency of all federal authority and responsibility provides a working model. The Authority depends on state cooperation through permissive legislation and modification of existing doctrines of water rights to comply with federal plans. (McDonough-Florida)
W70-00935

GOVERNMENTAL TECHNIQUES FOR THE CONSERVATION AND UTILIZATION OF WATER RESOURCES: AN ANALYSIS AND PROPOSAL.

Yale L J, Vol 56, No 2, p 289-30-3, Jan 1947.

Descriptors: *Water resources development, *Federal-state water rights conflicts, *River basin development, *Watersheds (Basins), Interstate commissions, Interstate compacts, Legislation, Administrative agencies, Federal jurisdiction, State jurisdiction, Watershed management, Interstate rivers, Drainage, Federal government, Projects.
Identifiers: Regional drainage projects.

Many states fear federal encroachment by consenting to regional authorities and prefer to use interstate planning commissions, interstate compacts, and interstate public authorities. The interstate planning commission lacks coercive authority, funds, and may be foiled by the recalcitrance of a single state. Interstate compacts have the inherent limitations of federal and state constitutions and stress political compromise over effective water planning. The interstate public authorities closely resemble the regional valley concept in that the states agree to vest authority into one corporate body for continuous administrative supervision. This system is subject to the veto by the governor of each participating state, and all new major projects must be authorized by the state legislatures involved. The solution is the creation by Congress of a national corporation and the negotiation of interstate compacts giving the corporation a delegation of important state powers over water resources. The fusion of national and local power into a single agency and the passing of state enabling legislation will provide an effective means of solving the problem of river basin drainage. (McDonough-Florida)
W70-00936

CANALS AND WATERWAYS (UPPER MISSISSIPPI RIVERWAY COMPACT).

Ill Ann Stat ch 14, sec 1101, art V, 'Powers', (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Water resources planning, *Interstate commissions, *Interstate compacts, Mississippi River, Administrative agencies, Legislation, Regulation, Public benefit, Water resources, Natural resources, Land resources, Administration, State governments, Management, Water policy, Parks, Recreation, River basin development, Water resources development, Water pollution, Water quality control, Erosion control, Planning, Diversion.

The Upper Mississippi Riverway Compact, which establishes the Upper Mississippi Riverway District and the Upper Mississippi Riverway Commission, confers certain powers on the Commission. These include the power to conduct studies and develop recommendations for the present and future protection, use, and development in the public interest of the river valleys and waters in, adjacent to, and affecting the Upper Mississippi Riverway District with respect to: (1) joint regional planning for the development of such areas; (2) measures for controlling water pollution, maintaining water quality, and controlling water use; (3) programs for control of soil and river-bank erosion and the general improvement of the river basins; and (4) diversion of waters to and from the rivers. The Commission and its properties are not subject to taxation. The Commission may provide coordinated services to two or more parks and may open its facilities to the public. The Commission must submit a budget to the appropriate state officer and may not pledge the credit of any party state. The Commission may regulate land and water resources. Nothing in the Compact limits the jurisdiction of any party state or federal government. A party state may withdraw from the Compact by payment of fair value and reacquire all real property located within the state. (Moulder-Florida)
W70-00939

TOMBIGBEE - TENNESSEE WATERWAY DEVELOPMENT COMPACT.
Miss Code Ann secs 5956-45 thru 5956-48 (Supp 1968).

Descriptors: *Mississippi, *Interstate compacts, *Interstate rivers, *Interstate commissions, Cooperatives, Governments, State governments, Water policy, Water resources development, Tennessee River, Alabama, Kentucky, Tennessee, Florida, Rivers, Channels, Construction, Administrative agencies, Federal government, Legislation, Planning, Navigation, Coordination, Navigable waters.

The compact's purpose is to promote the development of a navigable waterway connecting the Tennessee and Tombigbee rivers so as to provide a navigable channel and create a joint interstate authority between Alabama and Mississippi. The party states shall create the Tennessee-Tombigbee Waterway Development Authority, the purpose of which is the promotion and coordination of said waterway. The Authority is empowered to hold hearings, conduct studies and surveys, acquire necessary land, cooperate with all concerned groups or agencies, coordinate representation and support in Congress, and exercise all powers appropriate to these purposes. Financial contribu-

ions of each party state are in the proportion its population bears to the total population of all party states. Tennessee, Kentucky, and Florida are admitted as party states. (Darragh-Florida)
W70-00945

A PHYSICAL AND ECONOMIC ANALYSIS OF ALTERNATIVE IRRIGATION METHODS IN A SUB-HUMID CLIMATE,
North Dakota State Univ., Fargo.
For primary bibliographic entry see Field 03F.
W70-01086

POLLUTION--CAUSES, COSTS, CONTROLS.

Chem Eng News, p 33-68, June, 1969. 18 p, 13 fig.

Descriptors: Air environment, *Air pollution, *Atmospheric pollution, Manufacturing, Environment, Environmental sanitation, Wastes, Industrial wastes, Contamination, Waste treatment, Waste water (Pollution), *Water pollution, Water quality, Water quality act, *Water pollution control, Water pollution sources, Costs, *Pollution abatement, Legislation.
Identifiers: *Air pollution control, Exhaust gases, *Pollution control.

The principal causes of air and water pollution, the costs of pollution abatement, and the legislative and enforcement measures taken by various levels of government to control the environment are reviewed. Important technological developments and actions taken by industry to halt pollution are included. The increasing magnitude of the problem is caused by 2 main factors: urbanization and technical advance. Today's water pollution problems are much different than the typhoid fever problems a few decades ago; the problems today are concerned with synthetic chemical contaminates. The Federal Water Pollution Control Administration estimates that at least $26 billion will be needed to bring lakes and streams up to water quality standards by 1973. Federal, state, and local air and water pollution programs are discussed. Federal legislation on air and water pollution is reviewed. A resume is included of the Manufacturing Chemists Association report on the activities of the chemical manufacturing industry to control pollution. A directory is given of companies offering equipment, products, services, or supplies for use in pollution control. (USBR)
W70-01100

RIPARIAN WATER RIGHTS V A PRIOR APPROPRIATION SYSTEM: A COMPARISON,
Charles M. Haar, and Barbara Gordon.
Boston U L Rev, Vol 38, No 2, p 207-255, Spring 1958. 49 p, 50 ref.

Descriptors: *Riparian rights, *Prior appropriation, *Water rights, *Massachusetts, Water utilization, Water law, Legislation, Riparian land, Priorities, Water users, Surface-groundwater relationships, Surface waters, Groundwater, Legal aspects, Reasonable use, Riparian waters, Prescriptive rights, Administrative agencies.

A riparian state like Massachusetts needs to evaluate its own riparian system before discarding or modifying it in favor of a revision of water rights under a prior appropriations system. A proposed Michigan statute adopting a prior appropriation system and the present Massachusetts riparian system based upon common law traditions, case law, and statutes provides a basis for an initial comparison of the two systems, including discussions of watercourses, surface water, riparian land, appurtenant water rights, abandonment of water rights and groundwater. The adoption of a prior appropriation system in Massachusetts would have the effect of changing the present law, rather than merely declaring the law with the probable result of changing various property rights and obligations. A change from the riparian rule of 'reasonable use' to a prior appropriation system would also prove to be a costly solution without sufficient benefits over the present system. The seeming virtues of a fixed appropriation system should not be held as necessarily superior to a system of administrative and case determination of water rights. An analysis of water problems under the present system is preferred over the adoption of a different system. (McDonough-Florida)
W70-01139

RIPARIAN WATERS RIGHTS V A PRIOR APPROPRIATION SYSTEM: A COMPARISON,
Charles M. Haar, and Barbara Gordon.
Boston U L Rev, Vol 38, No 2, p 208-235, Spring 1958.

Descriptors: *Massachusetts, *Riparian rights, *Prior appropriation, *Water users, Water rights, Water law, Riparian waters, Reasonable use, Priorities, Water utilization, Legislation, Legal aspects, Riparian land, Prescriptive rights.

Massachusetts' riparian law is compared with a proposed Michigan prior appropriation statute to determine if the Commonwealth should adopt that system. The Michigan statute divides water rights into Class A riparian rights and Class B appropriative rights. Class B water users apply to a commission to obtain water priority rights. The Massachusetts riparian doctrine gives each riparian the right to reasonable use of all water available unless his right is enlarged or diminished by grant or prescription. This method allows a fundamental equality among claimants lacking in the prior appropriation system. Courts consider all circumstances to determine reasonable use as no lawful use is unreasonable per se. Courts must, however, await suits prior to determining water rights. Massachusetts Mill Acts provide for competing use of streams for power purposes without giving fixed priorities. This provides an amalgamation of statutory prior appropriation and common law reasonable use. The Michigan proposal would change Massachusetts law by limiting possible claimants to Class A owners without protecting non-riparian prescriptive users. (McDonough-Florida)
W70-01140

RIPARIAN WATER RIGHTS V A PRIOR APPROPRIATION SYSTEM: A COMPARISON,
Charles M. Haar, and Barbara Gordon.
Boston U L Rev, Vol 38, No 2, p 235-239, Spring 1958.

Descriptors: *Massachusetts, *Riparian rights, *Prior appropriation, *Water rights, Groundwater, Surface-groundwater relationships, Surface waters, Priorities, Water users, Reasonable use, Riparian waters, Prescriptive rights, Water law, Legal aspects, Legislation, Diversion.

The Michigan proposal defines 'watercourse' as a natural stream in a definite natural channel. The Massachusetts definition is similar but includes man-made channels within the 'natural' category. The adoption of the Michigan section would be a codification of case law rather than a modification but may in fact exclude non-natural watercourses. Michigan defines surface water as occurring naturally on the surface of the ground rather than watercourses, lakes, or ponds. Although the term is not explicitly defined by Massachusetts' decisions, the concept is identical. A recitation of illustrative instances is a better view. Michigan views riparian land as the smallest tract held under one title in the chain leading to the present owner. Massachusetts considers land abutting a watercourse as riparian and does not attempt to limit the term in area. The Michigan proposal would limit water use to an amount for reasonable beneficial use and requires application and approval prior to any lawful diversion. Massachusetts allows all riparians any reasonable use not injuring others and allows the taking of prescriptive rights to water use. The Michigan proposal would change present law. (McDonough-Florida)
W70-01141

RIPARIAN WATER RIGHTS V A PRIOR APPROPRIATION SYSTEM: A COMPARISON,
Charles M. Haar, and Barbara Gordon.
Boston U L Rev, Vol 38, No 2, p 239-255, Spring 1958.

Descriptors: *Massachusetts, *Riparian rights, *Prior appropriation, *Administrative agencies, Water rights, Water law, Judicial decisions, Prescriptive rights, Riparian land, Legal aspects, Water law, Legislation, Reasonable use, Riparian waters, Water users, Planning.

Many of the advantages in a prior appropriation system lie in the nature of administrative agency determinations as contrasted with judicial determinants under a riparian doctrine. Agencies presume expertise, but Massachusetts also utilizes expertise by appointing a 'master' in water law cases. Although the prior appropriation fixes a quantity of water to be used indefinitely, it lacks the flexibility of judicial determinations. It doesn't follow that the repudiation of the riparian system in favor or a prior appropriation system will solve Massachusetts' problems. Massachusetts needs to gather more data on all phases of water law and appoint commissions to develop a series of comprehensive plans on water needs upon which courts can base their decisions. (McDonough-Florida)
W70-01142

PEARL RIVER BASIN DEVELOPMENT DISTRICT ACT.
Miss Code Ann secs 5956-251 thru 5956-253, 5956-255 thru 5956-258, 5956-260, 5956-261, 5956-269 (Supp 1968).

Descriptors: *Mississippi, *River basins, *Administrative agencies, *Water resources development, Rivers, Taxes, Financing, Tax rates, Leadership, Legislation, State governments, Federal government, Overflow, Dams, Erosion control, Floodwater, Flood protection, Flooding, Flood control, Recreation facilities, Parks, Appropriation, Eminent domain, Forests, Soil conservation, Tributaries.
Identifiers: *River basin districts.

To conserve, store, and regulate the waters of the Pearl River and its tributaries and their overflow waters, this act authorizes the organization of the Pearl River Basin Development District. The Act provides for the selection and composition of a board of directors for such District and establishes procedures for the District's creation. Counties becoming members of the District are required to make annual payments thereto from funds raised by special tax levy. Numerous powers are given the District, including the power: (1) to impound and appropriate overflow and surface waters of the Pearl River and its tributaries; (2) to forest and reforest; (3) to prevent soil erosion; (4) to acquire lands by condemnation; (5) to require relocation of roads, railroads, power lines, and other named facilities; (6) to inundate public lands; (7) to establish and operate necessary facilities; and (8) to establish public parks and recreation facilities. The Act further gives the board of directors power to promulgate regulations for the District and set forth penalties for violations thereof. The District may also borrow money and issue bonds. (H R Marsee-Florida)
W70-01157

PEARL RIVER BASIN DEVELOPMENT DISTRICT ACT.

Miss Code Ann secs 5956-251 thru 5956-253, 5956-255, 5956-256 (Supp 1968).

Descriptors: *Mississippi, *River basins, *Administrative agencies, *Water resources development, Soil conservation, Rivers, Taxes, Tax rate, Financing, Leadership, Legislation, State governments, Overflow, Erosion control, Dams, Floodwater, Flood protection, Flooding, Flood control, Recreation facilities, Parks, Forests, Forestry, Tributaries, Water pollution control, Pollution abatement.
Identifiers: *River basin districts.

The Pearl River Basin Development District is created to conserve, store, and regulate the waters and overflow waters of the Pearl River and its tributaries for: (1) commercial, municipal, industrial, agricultural, and manufacturing purposes; (2) recreational uses; (3) flood control; (4) timber development and irrigation; (5) navigation; (6) soil conservation; and (7) pollution abatement. All powers of the District shall be exercised by a board of directors to be selected and composed as herein provided. Any county may, through its board of supervisors, become a member of the District. Counties becoming members of the District are required to make annual payment thereto from funds raised by special tax levy. (Marsee-Florida)
W70-01158

PEARL RIVER BASIN DEVELOPMENT ACT.

Miss Code Ann secs 5956-257, 5956-258, 5956-261, 5956-260, 5956-269 (Supp 1968).

Descriptors: *Mississippi, *River basins, *Administrative agencies, *Water resources development, Rivers, Legislation, State governments, Federal government, Overflow, Dams, Erosion control, Floodwater, Flood protection, Flood control, Recreation facilities, Parks, Appropriation, Eminent domain, Forests, Soil conservation, Tributaries, Grants, Financing, Surveys.
Identifiers: *River basin districts.

The Pearl River Basin Development District is empowered to: (1) develop, in conjunction with federal and state agencies, plans for the conservation, development, storage, and regulation of soil and waters within the Pearl River Basin; (2) develop waters for navigation and prevention of flood damage; (3) acquire property by purchase, lease, or gift; (4) obtain grants and loans from the United States; (5) contract; (6) make surveys relating to the construction of dams and reservoirs; (7) impound for beneficial use the overflow and surface water of the Pearl River and its tributaries; (8) forest and reforest, and prevent soil erosion and flooding within the District; (9) store and preserve waters for irrigation and prevention of water pollution; (10) acquire property interests by eminent domain; (11) require the relocation of roads and highways, railroad lines, telephone and telegraph lines, properties, electric power lines, gas pipelines, and mains and facilities; (12) inundate public lands; (13) issue bonds; (14) fix and collect charges for services, facilities, or commodities furnished by the District; (15) lease or sell property; and (16) establish public parks and recreation facilities. (Marsee-Florida)
W70-01159

FEDERAL WATER RESOURCES DEVELOPMENT.

Va Code Ann secs 62.1-148 thru 62.1-152 (1968).

Descriptors: *Virginia, *Local governments, *Water resources development, *Federal government, Flood control, River and Harbors Act, Rivers, Harbors, Easements, Right-of-way, Eminent domain, Condemnation, Dams, Roads, Spillways, Leases, Pipelines, Dikes, Drains, Dredging, Cutoffs, Federal project policy, Projects.

The governing body of any county, city, or town may assure the federal government of fulfillment of the required items of local cooperation that are conditions precedent to the accomplishment of river and harbor flood control projects of the United States. Such assurances, by resolutions or ordinances, may irrevocably bind such county, city, or town: (1) to provide lands, easements, or rights-of-way; (2) to alter existing structures on such areas; (3) to dredge areas not covered by the federal project when required; (4) to construct and maintain public wharves, roads, and marine railways; (5) to remove sewer pipes and submarine cables; (6) to hold the United States harmless against claims for damages; and (7) to provide any other conditions of local cooperation required in the pertinent congressional document. To comply with such terms of local cooperation, the necessary lands may be acquired by lease, purchase, gift, or condemnation. This chapter shall be liberally construed. (Schram-Florida)
W70-01179

WATER POWER AND RESOURCES.
Va Code Ann secs 10-113 thru 10-113.2, 10-115 thru 10-117.1 1964.

Descriptors Virginia, Water resources development, Administrative agencies, Hydroelectric power, Artesian wells, Conservation, Water resources, Resources, Control, Water supply, Surveys, Industrial water, Farms, Seasonal, Streams, Rivers, Water storage, Legislation, Resource development, Industries, Fluctuation, Administration.

In the Department of Conservation and Development there shall be a Division of Water Resources. The Commissioner of Water Resources shall exercise all powers conferred upon him by law, including those in relation to water power, resources, development, and control. The Director of Conservation and Development shall take evidence and report findings concerning conservation of the state's water supply. He shall gather and disseminate information relative to the water powers and industrial advantages in this state. To promote the systematic development of such industrial resources, a comprehensive water power survey shall be made showing the resources and commercial needs of hydroelectric power for community or farm purposes. Such survey shall include the extent of the water powers suitable for profitable use, both developed and undeveloped, the maximum and minimum power available according to seasonal flow of various streams, the possible uses of water storage and conservation, and the advantages of interconnecting hydroelectric systems. The owner of any artesian well shall secure the mouth of such well so as to prevent the waste of any water. Smith-Florida
W70-01192

THE LAND AND WATER USE SURVEY OF NORTH-CENTRAL KORDOFAN (1961-66),
London Univ. (England). School of Oriental and African Studies.
For primary bibliographic entry see Field 03B.
W70-01198

THE CHANGING ROLE OF WATER IN ARID LANDS,
Chicago Univ., Ill. Dept. of Geography.
Gilbert F. White.
Arizona Review, Vol 17, No 3, p 1-8, Mar 1967. 8 p.

Descriptors: *Arid lands, *Water resources development, *Water allocation (Policy), *Urbanization, *Consumptive use, Evapotranspiration control, Desalinization, Economics, Irrigation, Industrial water, Social aspects, Water rates, Technology.

This paper is based on a lecture delivered by Dr. White at the University of Arizona in 1960. The author states that one-third of the earth's surface is arid. New pressures on arid lands set the scene for unprecedented social and technical changes. New technology is rapidly advancing the finding, lifting, storing, conveyance, and treatment of water. Urbanization is leading to industrial growth and demand for water. In many areas consumptive use has approached the potential supply. Still, large volumes are annually lost to evaporation and transpiration. In Asia and Africa much irrigated land is lost to water logging and salinization even as new lands are developed. Better use of present irrigation water is needed. A change in public attitude is required to set fair prices that will force rational reallocation of existing water supplies, develop methods for equitable transfer, and make more rational decisions on new investment in water development. New emphasis in technology may be needed: investment in research to reduce evapotranspiration losses may be a better alternate than new salt-water conversion works which have application only to limited areas. (Crouse-Arizona)
W70-01199

THE ECONOMICS OF ARIZONA'S WATER PROBLEM,
Arizona Univ., Tucson. Dept. of Aricultural Economics.
For primary bibliographic entry see Field 06D.
W70-01200

THE ASWAN HIGH DAM,
Texas Univ., Austin.
Robert K. Holz.
Professional Geographer, Vol 20, No 4, p 230-237, July 1968. 8 p, 2 tab, 3 fig, 7 ref.

Descriptors: *Arid lands, *Dam Construction, *Land reclamation, *Reservoir evaporation, *Population, Irrigated land, Reservoir leakage, Multi-purpose projects, Economic impact, Social impact, SCIENCE IMPACT, Benefits.
Identifiers: *Aswan Dam, *United Arab Republic, *Nile Valley.

Egypt has tied much of their hope for political, social, and economic development to construction of the High Aswan Dam. There is little doubt that it will be completed on schedule in 1970 or earlier. However, recent studies have revised downward the estimated area that may be brought under irrigation as a result of availability of only marginal land, and uncertainties as to evaporative and seepage losses. However, there should be at least a 25% increase in cultivated land (1.5 million acres) and a doubling of national output of electricity as well as flood and navigation benefits. Aggregate income will increase but because of a rapidly increasing rate of population growth, per capita effects may be negligible among the masses of fellaheens. While a step in the right direction, the High Aswan Dam is not a panacea for Egypt's economic ills. (Crouse-Arizona)
W70-01201

OASES FOR THE FUTURE,
Rochester Inst. of Tech., N.Y.
Kenneth Hickman.
Ekistics, Vol 23, No 137, p 193-198, 1967. 6 p.

Descriptors: *Water resources development, *Water shortage, *Water supply, Desalination plants, *Reclaimed water, Water conveyance, Weather modification, Water waste treatment, Water reuse, Municipal water, Costs, Consumptive use.
Identifiers: *Oases.

This is a general review of the world's water 'problem' and possibilities for its solution. On the average the world's supply of fresh water is sufficient to meet world population needs for the forseeable future. The regional situation is very different - one in which much of the world is now or will soon be short of fresh water because of pollution of existing supplies or poor distribution of precipitation resulting in aridity. Aside from the apparently limited possibilities of weather modification, water can be reclaimed on site or redistributed by conveyance or saline water can be converted. In most cases cost becomes lower as the size of the project becomes larger. Hence, emphasis is on large scale projects for integrated areas. Since most water needs remain local, a real need exists for development of small, packaged units to convert or reclaim water. (Crouse-Arizona)
W70-01203

WATER SUPPLIES IN SOUTH AUSTRALIA,
Hull Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 03B.
W70-01204

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

AQUEDUCT ROUTE OPTIMIZATION BY DYNAMIC PROGRAMMING,
Technion - Israel Inst. of Tech., Haifa; and Water Planning for Israel Ltd., Tel Aviv. Water Supply Section.
For primary bibliographic entry see Field 04A.
W70-00894

6D. Water Demand

DYNAMIC ASPECTS OF URBAN WATER DEMAND,
Colorado School of Mines, Golden.
Steve H. Hanke.
Proc, Fourth Amer Water Resources Conf, NY, p 642-650, Nov 1968. 9 p, 1 fig, 1 tab, 18 ref.

Descriptors: *Mathematical models, *Optimization, *Design, *Water demand, *Planning, Water supply, Annual, Average, Seasonal, Rates, Distribution systems, Treatment, Water distribution (Applied), Municipal water.
Identifiers: Dynamic Model.

The problem of how to best manage urban water resources was discussed. The purpose of the paper was to present economic principles and techniques that would aid water managers when planning for optimal use of urban water resources. Designs based on the water 'requirements approach' ignored factors that could cause the demand function to shift or could induce movements along the function. The problem of optimally designing in detail the basic source, transmission treatment and local distribution components of an urban water supply could be tackled better if the following characteristics were known and understood: (1) average annual rate of demand; (2) seasonal average rates of demand; (3) the range of variation in the rates of demand; and (4) the frequency with which peak demands occur. A dynamic mathematical model for optimally designing and investing in urban water resources was developed and recommended over static approach design models. (Thiuri-Cornell)
W70-00899

THE DILEMMA OF WATER RECREATION AND A SUGGESTED SOLUTION,
G. Graham Waite.
Wis L Rev, Vol 1958, No 4, p 542-609, July 1958. 58 p, 248 ref.

Descriptors: *Wisconsin, *Recreation facilities, *Lakes, *Competing uses, Water rights, Riparian rights, Land tenure, Reasonable use, Relative rights, Water utilization, Recreation demand, Water demand, Public health, Access routes, Land use, Non-consumptive use, Water allocation (Policy), Legal aspects, Judicial decisions, State governments, State jurisdiction, Federal jurisdiction, Navigable waters, Public rights.
Identifiers: *Lake management programs.

Pressures on state recreational facilities have created an urgent need for government action. Direct state management of navigable lakes is a possible solution to the problem of providing better facilities. Difficulties with the plan involve its apparent conflict with certain provisions of both the Northwest Ordinance of 1787 and the Wisconsin Constitution. A further problem is the extension of the trust theory, which provides that the state holds public rights in navigable waters in trust for the people of the state, to cover use of riparian lands owned by private persons for public access to navigable lakes and taxation of private riparian owners who use public waters exclusively. The author contends that the Northwest Ordinance is inapplicable today and that the government would not be violating the state constitution's general prohibition against state construction of internal improvements by managing navigable lakes. The state has a affirmative duty as trustee of public waters to promote public rights, and according to the author this justifies interference with private riparian lands. (Kelly-Florida)
W70-00930

THE DILEMMA OF WATER RECREATION AND A SUGGESTED SOLUTION (PART I),
G. Graham Waite.
Wis L Rev, Vol 1958, No 4, p 542-567, July 1958.

Descriptors: *Wisconsin, *Lakes, *Recreation facilities, *Access routes, State jurisdiction, Federal jurisdiction, Navigable waters, Public health, Recreation, Water resources, Water allocation (Policy), Legal aspects, Land tenure, Compensation, Condemnation, Water management (Applied), Water conservation.

Increasing population, increasing amounts of leisure time available to the working public, and a growing reluctance on the part of owners of private lakes to open them to public use have combined to render the state's water recreational facilities inadequate to meet the needs of its citizens. Comprehensive lake management by the state is suggested as a method of solving this problem. Some question exists regarding the state's ability to require payment for use of public waters, or to tax riparian owners who use navigable waters while excluding the public because of a prohibition of interfering with navigable waters and of taxing for their use contained in the Northwest Ordinance of 1787. It is uncertain whether the ordinance survived Wisconsin's admission into the Union, since it applied to the federal territories. Wisconsin's treatment of the ordinance has been ambiguous, but an interpretation that the ordinance is no longer applicable could be drawn from case law. The author submits that water conservation and allocation of water use, in a comprehensive scheme of navigable waters management rendering recreational facilities available to a greater number of persons, may receive favorable consideration in the courts. (Kelly-Florida)
W70-00931

THE DILEMMA OF WATER RECREATION AND A SUGGESTED SOLUTION (PART II),
G. Graham Waite.
Wis L Rev, Vol 1958, No 4, p 567-609, July 1958.

Descriptors: *Wisconsin, *Lakes, *Riparian rights, *Recreation facilities, Relative rights, Compensation, Reasonable use, Recreation, State jurisdiction, State governments, Judicial decisions, Water allocation (Policy), Navigable waters, Federal jurisdiction, Public health, Legal aspects, Recreation demand, Public rights, Water conservation, Water management (Applied).

The feasibility of a plan of state management of navigable lakes for recreational purposes depends in part upon the state's power to interfere with a riparian owner's use of his property without paying compensation. The author urges the courts to uphold this power, pointing to the present uncertainty in Wisconsin case law concerning both the riparian owners' exclusive access rights to adjoining navigable waters and the need for compensation of riparian owners for the kind of interference with their lands that a lake management program would require. The state constitutional prohibition against internal improvements being carried out by the state may impede the development of lake-management projects sponsored by the state. An exception to this rule is that the state may provide internal improvements in performing one of its governmental functions. Preservation and promotion of public rights in public waters can be construed as a governmental function under the trust theory because the trust in which the state holds navigable waters for the people is an active one and also because providing recreational facilities promotes public health. The author further urges state university projects on publicly-owned riparian land and comprehensive land use zoning to further the management plan. (Kelly Florida)
W70-00932

GOVERNMENTAL RESTRICTION OF WATER USE,
Charles N. Huber.
Wis L Rev, Vol 1959, No 2, p 341-346, Mar 1959. 6 p, 34 ref.

Descriptors: *Wisconsin, *Riparian rights, *Public rights, *Water pollution, Judicial decisions, Legal aspects, Legislation, Water law, Regulation, Boating, Swimming, Lakes, Water supply, Easements, Reasonable use, Cities, Recreation, Public utilities, Local governments, Natural streams, Relative rights, Remedies, Water pollution control.
Identifiers: *Riparian owners.

The defendant city acquired from plaintiff riparian owner an easement to take water from Lake Lavina. The city then passed an ordinance prohibiting contamination of the lake by bathing, boating, and swimming. The plaintiff sought to have the ordinance declared invalid as a taking of property without compensation. The trial court found for the city. The Wisconsin Supreme Court in Bino v City of Hurley, 273 Wis 10, 76 NW2d 571 (1956), reversed on the grounds that riparian owners have a right to the reasonable use of the water of the lake. This right is a property right which carries with it the privilege to use the lake for bathing, swimming, and boating purposes, and, if a city is to deprive a person of such a right, that person must be compensated. The criticism is made that the court, influenced by the equities of the case, announced too sweepingly that the riparian right here involved was a property right. The author suggests that the decision will have little precedential value in a similar situation involving a state statute because of the greater police power possessed by the state and because of the fact that, in reality, public rights as well as riparian rights were involved in Hurley. The argument is made that in Hurley the plaintiff's use was not reasonable in the sense that it resulted in contamination of a public water supply. (Keith-Florida)
W70-00938

SEWAGE FLOW VARIATIONS IN INDIVIDUAL HOMES,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01055

PEAK FLOWS OF SEWAGE FROM INDIVIDUAL HOUSES,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 08B.
W70-01062

RHODE ISLAND WATER RESOURCES BOARD.

R I Gen Laws Ann secs 46-15-1 thru 46-15-10, 46-15-13, 46-15-18, 46-15-19 (Supp 1968).

Descriptors: *Rhode Island, *Administrative agencies, *Water resources development, *Water policy, Water resources, Legislation, Legal aspects, Droughts, Water supply, Water permits, Permits, Water requirements, Water shortage, Water utilization, Water works, Water yield improvement, Administration, Cities, State governments, Leadership, Local governments, Planning, Multiple-purpose projects, Taxes, Regulation, Coordination.

The greatly accelerated demands for more water and a continuing drought have created such serious problems of water resource development, utilization, and control that coordinated governmental and private action is necessary. For this purpose the Water Resources Board is created and its powers and duties set forth. The qualification

procedures for appointment and expenses of Board members are provided. The powers of municipal water agencies, special water districts, and private water companies are restricted. These entities must acquire the approval of the Board before performing specified acts related to water supply facilities. The procedure for the approval of project plans and maps is outlined. No governmental agency or district nor any private company may supply water to other states or water supply systems without Board approval. The Board is granted the power to: (1) enter upon lands and waters for purposes of survey; (2) examine the books, records, and accounts of municipal water departments, special water districts, and private water companies; and (3) require the above bodies to file reports with the Board. The Board's relation to governmental agencies is defined, and Board properties and facilities are exempted from taxation. (Marsee-Florida)
W70-01187

RHODE ISLAND WATER RESOURCES BOARD.
R I Gen Laws Ann secs 46-15-1 thru 46-15-5 (Supp 1968).

Descriptors: *Rhode Island, *Administrative agencies, *Water resources development, *Water policy, Water resources, Legislation, Legal aspects, Droughts, Water requirements, Water shortage, Water utilization, Water yield improvement, Administration, Cities, State governments, Leadership, Local governments, Planning, Institutions, Multiple-purpose projects.

In recent years the combination of new technology resulting in accelerated water demand, population growth, and a continuing drought has threatened the supply of water for domestic, industrial, and recreational use. State government, State and municipal departments, special districts, and private firms must coordinate their efforts toward the control, utilization, and development of the state's water resources. Toward this goal, the Water Resources Board is created. Each member of the Board must be qualified and appointed as provided herein. The members serve without compensation but are reimbursed for their expenses. The officers of the Board and the vote required for action are designated. (Marsee-Florida)
W70-01188

RHODE ISLAND WATER RESOURCES BOARD.
R I Gen Laws Ann secs 46-15-6 thru 46-15-10 (Supp 1968).

Descriptors: *Rhode Island, *Water resources development, *Water supply, *Water policy, Administrative agencies, Water resources, Legislation, Legal aspects, Loans, Water requirements, Water utilization, Water yield improvement, Administration, Cities, State governments, Local governments, Institutions, Multiple-purpose projects, Water permits, Permits, Reservoir operation, Pipelines, Eminent domain, Water works, Water zoning, Long-term planning, Regulation, Supervisory control (Power).

The Water Resources Board shall have the powers and duties to: (1) acquire the properties and facilities necessary for reservoirs and the treatment and distribution of water from the same; (2) exercise the power of eminent domain; (3) construct or purchase water supply facilities where no municipal water agency, special water district, or private water company is willing or able to do so; (4) formulate long-range programs for the development of water sources, transmission systems, and distribution systems; (5) divide the state into areas for providing water supply facilities; (6) regulate the construction and operation of water supply facilities within each area; and (7) make loans to public water supply agencies. No municipal water agency, special water district, or private water company may, without the Board's approval: acquire a water supply, take lands, extend supply or distribution, extend transmission mains, extend water district boundaries, or supply water to municipalities already supplied by another agency. The procedure for obtaining such approval is outlined. No governmental agency or district nor any private company may supply water to other states or to other water supply systems without Board approval. (Marsee-Florida)
W70-01189

RHODE ISLAND WATER RESOURCES BOARD.
R I Gen Laws Ann secs 46-15-13, 46-15-18, 46-15-19 (Supp 1968).

Descriptors: *Rhode Island, *Administrative agencies, *Water resources development, *Taxes, Water resources, Water supply, Legislation, Legal aspects, Water works, Administration, Cities, State governments, Local governments, Assessments, Institutions, Leases, Surveys, Investigations, Supervisory control (Power).

The Rhode Island Water Resources Board has the authority to enter upon lands and waters for the purpose of making surveys, investigations, or examinations. Neither the Board nor any municipal water agency or department or special water district to whom the Water Resources Board has leased its properties or facilities shall be required to pay taxes on the same, or upon the income therefrom. The Board is empowered to make general rules and regulations for the enforcement of this Act. (Marsee-Florida)
W70-01190

THE ECONOMICS OF ARIZONA'S WATER PROBLEM,
Arizona Univ., Tucson. Dept. of Aricultural Economics.
Robert A. Young, and William E. Martin.
Arizona Review, Vol 17, No 3, p 9-18, 1967. 10 p, 6 tab, 14 ref.

Descriptors: *Arizona, *Agriculture, *Economics, *Cost-Benefit ratio, *Overdraft, Arid lands, Groundwater, Consumptive use, Irrigation, Water allocation (Policy), Water policy.
Identifiers: *Growth (Economic), *Central Arizona Project.

The authors hold that in Arizona, where per capita water consumption ranks among the highest in the nation, the price system should be proportionate to allocation of the water. At present the annual water deficit which is met by overdraft of groundwater, is 3.5 million acre feet, an amount equal to that consumed by low value extensive crops. These crops rank lowest among economic activities of the state in terms of dollars of personal income returned per acre foot of water used. Arizona's water problem is not one of physical shortage but of allocation of available water those economic sectors that will maintain a high rate of economic growth. Their estimates based on present plans for allocating Colorado River water diverted through the proposed Central Arizona Project cast doubt as to whether the Project can generate economic benefits in excess of costs of construction and operation. The fact that sufficient resources are available to finance the Project is no measure of its economic desirability. (Crouse-Arizona)
W70-01200

PATTERNS OF WATER USE IN THE ARIZONA ECONOMY,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
William E. Martin, and Leonard G. Bower.
Arizona Review, Vol 16, No 12, Dec 1966, p 1-6. 6 p, 3 tab.

Descriptors: *Arizona, *Economics, *Overdraft, *Groundwater, *Agriculture, Decision making, Economic justification, Irrigation water, Consumptive use, Water demand, Industrial water, Municipal water, Input-output analysis, Water allocation (Policy).
Identifiers: *Central Arizona Project.

Although water is scarce in Arizona its per capita use is over three times the national average. Past needs were met by diverting surface flow or tapping underground supplies. Solution of today's problem involves development of supplies outside the state or reallocation of existing supplies within the state, or both. In 1958 agricultural industries used over 90% of the water supplied for economic production. Relative use has probably remained similar. Food and feed grains consume about 50 acre-feet of water per $1,000 output, compared with .032 acre-feet for the same value output in the mining industry. All uses total approximately seven million acre-feet per year compared with average annual income of 3.6 million acre-feet. Even with the addition of 1.2 million acre-feet from the Central Arizona Project there will be a large deficit and some reallocation will eventually be necessary even without growth. From the data presented it is evident that crucial reallocation decisions will likely fall upon crop agriculture if continued overdraft of groundwater is to be checked. (Crouse-Arizona)
W70-01202

WATER RESOURCES AND THE CHEMICAL INDUSTRY IN NEW JERSEY: AN ECONOMETRIC AND ENGINEERING ANALYSIS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
M. L. Granstrom, M. Dutta, and J. DeRooy.
Available from the Clearinghouse as PB-187 727, $3.00 in paper copy, $0.65 in microfiche. Research Project Technical Completion Report, Water Resources Research Institute, Rutgers University - The State University of New Jersey, New Brunswick, New Jersey. Oct 1969. 303 p, 80 tab, 20 fig, 108 ref. OWRR Proj B-001-NJ and A-010-NJ.

Descriptors: *Water demand, *Water requirements, Water supply, Water utilization, Elasticity of demand.
Identifiers: *Chemical industry, Econometrics.

This report applies modern econometric and engineering techniques to the analysis of relationships of water to the chemical industry. Questionnaires were devised to obtain quality, quantity and costs of water taken in and discharged. Industrial demand for water resources is discussed in terms of production functions and technological change. Industrial demands for the future are projected for the chemical industry of New Jersey. (Whipple-Rutgers)
W70-01217

6E. Water Law and Institutions

STATE HIGHWAYS.
For primary bibliographic entry see Field 04A.
W70-00888

DAMS.
For primary bibliographic entry see Field 04A.
W70-00891

CONDEMNATION BY CITIES, COUNTIES, AND DISTRICTS FOR FLOOD CONTROL OR DRAINAGE.

Ky Rev Stat Ann secs 104.170-104.180 (1963).

Descriptors: *Kentucky, *Flood control, *Cities, *Condemnation, Legislation, Drainage, Levees, Soil conservation, Judicial decisions, Administrative agencies, Overflow, Local governments, Drainage districts, Flood protection, Channel improvement.

When any land, right of way, or easement over or through any property is needed by a city, county,

flood control, drainage, levee, reclamation or soil conservation district to perform work for flood control, flood protection or drainage purposes, the governing body may order the condemnation of the land or right of way. The judge of the circuit court shall grant and award immediate possession and full and complete use and control of said land or right of way to the city, county, flood control, drainage, levee, reclamation, or soil conservation district by an interlocutory judgment which shall be ordered immediately after the filing of the report by the commissioners appointed by the court. The commissioners may report at any time after summons has been fully issued or a warning order attorney appointed. The court may require a bond to be executed. The condemnation may not be abandoned after possession has been obtained unless none of the defendant parties will be materially prejudiced thereby. Cities of the fourth class may acquire land by purchase or condemnation for the purpose of straightening or widening any creek running through the corporate limits of the city to prevent or lessen the overflow thereof. (Heckerling-Florida)
W70-00895

LOWER MISSISSIPPI RIVER BASIN DEVELOPMENT DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00912

FERRIES.
For primary bibliographic entry see Field 04A.
W70-00913

BASIC CONCEPTS IN GROUND WATER LAW,
For primary bibliographic entry see Field 04B.
W70-00914

THE CONSTITUTIONAL ASPECTS OF WATER POLLUTION AND THE NEED FOR GOVERNMENTAL COOPERATION,
For primary bibliographic entry see Field 05G.
W70-00915

PRIVATE WATER RIGHTS IN FRANCE AND IN THE EASTERN UNITED STATES,
For primary bibliographic entry see Field 06B.
W70-00916

PRIVATE WATER RIGHTS IN FRANCE AND IN THE EASTERN UNITED STATES,
For primary bibliographic entry see Field 06B.
W70-00917

PRIVATE WATER RIGHTS IN FRANCE AND IN THE EASTERN UNITED STATES,
For primary bibliographic entry see Field 06B.
W70-00918

PRIVATE WATER RIGHTS IN FRANCE AND IN THE EASTERN UNITED STATES,
For primary bibliographic entry see Field 06B.
W70-00919

NOTES ON WATER WORKS LAW SECOND INSTALLMENT - IRRIGATION AND RIPARIAN RIGHTS,
For primary bibliographic entry see Field 06B.
W70-00920

COMMENT: EXTENDING THE APPLICATION OF THE LAW OF ACCRETIONS.
For primary bibliographic entry see Field 04A.
W70-00921

CONSTITUTIONAL LAW--COMMERCE CLAUSE--WATER RIGHTS IN THE FLOW OF A NON-NAVIGABLE STREAM ARE PROPERTY RIGHTS,
For primary bibliographic entry see Field 04A.
W70-00922

STATUTORY STREAM POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
W70-00923

STATUTORY STREAM POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
W70-00924

STATUTORY STREAM POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
W70-00925

STATUTORY STREAM POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
W70-00926

REAL PROPERTY--RIPARIAN GRANTS--LEGISLATIVE LIMITATIONS ON EXTENT OF GRANT.
For primary bibliographic entry see Field 06B.
W70-00927

FEDERAL REGULATION OF WATERWAYS.
For primary bibliographic entry see Field 04A.
W70-00928

WATER AND WATER COURSES--SERVITUDES--ARTICLE 660, LOUISIANA CIVIL CODE OF 1870.
For primary bibliographic entry see Field 04A.
W70-00929

THE DILEMMA OF WATER RECREATION AND A SUGGESTED SOLUTION,
For primary bibliographic entry see Field 06D.
W70-00930

THE DILEMMA OF WATER RECREATION AND A SUGGESTED SOLUTION (PART I),
For primary bibliographic entry see Field 06D.
W70-00931

THE DILEMMA OF WATER RECREATION AND A SUGGESTED SOLUTION (PART II),
For primary bibliographic entry see Field 06D.
W70-00932

WATER POLLUTION CONTROL AND ABATEMENT (BOOK REVIEW); CONTROLLING POLLUTION: THE ECONOMICS OF A CLEANER AMERICA (BOOK REVIEW),
For primary bibliographic entry see Field 05G.
W70-00933

GOVERNMENTAL TECHNIQUES FOR THE CONSERVATION AND UTILIZATION OF WATER RESOURCES: AN ANALYSIS AND PROPOSAL.
For primary bibliographic entry see Field 06B.
W70-00934

GOVERNMENTAL TECHNIQUES FOR THE CONSERVATION AND UTILIZATION OF WATER RESOURCES: AN ANALYSIS AND PROPOSAL.
For primary bibliographic entry see Field 06B.
W70-00935

GOVERNMENTAL TECHNIQUES FOR THE CONSERVATION AND UTILIZATION OF WATER RESOURCES: AN ANALYSIS AND PROPOSAL.
For primary bibliographic entry see Field 06B.
W70-00936

NAVIGABLE WATERS--ARTIFICIAL LAKE CONNECTED TO RIVER,
For primary bibliographic entry see Field 04A.
W70-00937

GOVERNMENTAL RESTRICTION OF WATER USE,
For primary bibliographic entry see Field 06D.
W70-00938

CANALS AND WATERWAYS (UPPER MISSISSIPPI RIVERWAY COMPACT).
For primary bibliographic entry see Field 06B.
W70-00939

DRAINAGE (CHICAGO SANITARY DISTRICT).
For primary bibliographic entry see Field 04A.
W70-00940

DRAINAGE-SELECTION, QUALIFICATIONS, POWERS, AND DUTIES OF COMMISSIONERS AND OTHER OFFICERS.
For primary bibliographic entry see Field 04A.
W70-00941

WATER-DRAINAGE AND LEVEE DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00942

FISH AND GAME (LICENSES).
Ind Ann Stat secs 11-1425 thru 11-1433c (1956), as amended, (Supp 1968).

Descriptors: *Indiana, *Fish, *Permits, Legislation, Regulation, Ponds, Recreation, Water sports, Fish management, Fish conservation, Nets, Fishing gear, Fishing.
Identifiers: Penalties.

Free permits to possess or purchase fish or game animals are issued to organizations organized for the purpose of wildlife protection. It is unlawful to use explosives in state waters without a permit. Applicable fines are included. Owners of private ponds may obtain free permits to use seines or traps on their premises. Indiana provides for reciprocal fishing permits with any state allowing Indiana residents to fish, without requiring a non-resident license, in waters forming a common boundary between Indiana and that state. (Moulder-Florida)
W70-00943

FISH (SEASONS, LIMITS, SPAWNING GROUNDS).

Ind Ann Stat secs 11-1601 thru 11-1604d (1956), as amended, (Supp 1968).

Descriptors: *Indiana, *Fish, *Spawning, *Fishing, Sport fishing, Legislation, Regulation, Administrations, Wildlife conservation, Fishing gear, Explosives, Electrical shocking gear, Fish toxins, Nets, Seines, Smelts, Fish conservation, Fish management.
Identifiers: Penalties.

Fishing regulations covering closed seasons, lawful catches, minimum sizes, and bag limits are provided. The Director of the Department of Conservation sets aside lakes and streams as spawning grounds wherein it is unlawful to fish, operate any motorboat, or take any minnows. Unlawful fishing methods, with certain exceptions, are set forth and include the use of gig or spear, electrical device, dynamite, or fish toxins. Penalties for violation of

these provisions are provided. The taking of smelt is regulated. (Moulder-Florida)
W70-00944

TOMBIGBEE - TENNESSEE WATERWAY DEVELOPMENT COMPACT.
For primary bibliographic entry see Field 06B.
W70-00945

COMMERCIAL FISHING DEVICES - REGULATIONS.

Ind Ann Stat secs 11-1619 thru 11-1643 (1956).

Descriptors: *Indiana, *Fish, *Interstate compacts, *Fishing gear, Legislation, Regulation, Administration, Equipment, Nets, Commercial fishing, Trout, Trawling, Organic wastes, Pollution, Public health, Conservation, Dams, Water pollution, Lake Michigan, Fish conservation.
Identifiers: Penalties.

Interstate compacts may be entered into when necessary to protect fish in waters forming a common boundary line with some other state. Regulations pertaining to recording each day's catch, the locality fished, and the type of gear used in fishing Lake Michigan are included. It is unlawful for any person or firm to use nets, seines, and traps of specific types in Lake Michigan. Provisions for the use of commercial fishing nets and their impoundment for violations of the provisions are set forth. Season and size limit regulations for waters of the state as well as regulations concerning the unlawful use of certain fishing devices in Lake Michigan are included. The Department of Conservation may alter the above regulations. Certain regulations concerning lawful and unlawful fishing devices, undersize fish, and dams on the Wabash River boundary line are provided herein. All residue eminating from the catching, curing, or cleaning of fish in or near Lake Michigan shall be disposed of in a manner which will not pollute such waters. (Moulder-Florida)
W70-00946

SALVAGE.

Miss Ann Code secs 1007, 1008, 1010, 1011, 1019 (1956).

Descriptors: *Mississippi, *Watercourses, *Ownership of beds, *Streambeds, Legislation, Legal aspects, Gulf of Mexico, Boats, State jurisdiction, State governments, Relative rights, Remedies.
Identifiers: *Salvage, Salvage rights.

Any floatable thing of value that becomes derelict in any watercourse of the state or in the beds thereof and which has been relinquished, deserted, or abandoned shall become the property of the owner of the bed of the stream. Such owner may raise, float, or salve said property. Any person claiming to be the owner of such property may institute an action in replevin for the recovery of such property. The defendant in such suit shall have a lien against the salvaged property for the expense of raising it. Any person who desires to claim compensation for salvage services rendered shall file a petition in the circuit court. If any person shall convert to his own use any floatable thing of value not belonging to him, he shall be guilty of a misdemeanor punishable by a fine of not less than double the value of the property converted or imprisonment not exceeding six months. (Schram-Florida)
W70-00947

HIGHWAYS, FERRIES, WATERWAYS.

Miss Code Ann secs 2203, 2205, 2206, 2210, 2211 (1956).

Descriptors: *Mississippi, *Bridges, *Bridge failure, *Navigable waters, Streams, Canals, Channels, Navigation, Transportation, Bays, Harbors, Water law, Legislation, Legal aspects, Lumbering.
Identifiers: *Obstructions to navigation.

If any keeper or owner of a public ferry, toll-bridge, or causeway shall fail to give bond as required by law, suffer said structure to be out of good repair for more than five days, or cause any person to be unreasonably detained by carelessness, wilfulness, or negligence, such owner or keeper, upon conviction, shall be fined not more than fifty dollars. Any person who wilfully obstructs, breaks, or destroys any bridge, causeway, or ferry, which was established for the convenience of the public by the proper authority, shall be fined not more than one hundred dollars. Any person who obstructs in any way a stream or canal not less than one hundred and fifty feet wide without immediately removing the obstruction shall be guilty of a misdemeanor and shall be fined not more than fifty dollars or be imprisoned not more than one week. If any person shall obstruct any navigable bay, river, creek, or other navigable channel or shall discharge any ballast in a place other than that designated by the harbor commissioners, the offender shall be fined not more than one thousand dollars or imprisoned not longer than six months. (Schram-Florida)
W70-00948

FISH POISONING; POISONING WATER SUPPLY.
For primary bibliographic entry see Field 05G.
W70-00949

NAVIGABLE WATERS - PUBLIC HIGHWAYS.

Miss Code Ann secs 8413 thru 8418 (1956).

Descriptors: *Mississippi, *Navigable waters, *Navigation, Legislation, Navigable rivers, Lumbering, Bridges, Remedies, Obstruction to flow, State governments, Administration, Water law, Water policy, Water zoning, Water courses, Public rights.

All watercourses that have been or may be declared navigable, by act of the legislature or by the Board of Supervisors of the county in which the same may be, shall be public highways. All rivers, creeks, and bayous of twenty-five miles in length that have sufficient depth and width for thirty consecutive days in the year for floating a steamboat are declared to be navigable waters. Any person may enter and remove any and all obstructions across, in, or over any navigable stream. If any person obstructs a navigable stream by allowing logs to accumulate thereon, any other person may cause the jam to be broken. The cost for breaking the jam shall be borne by the owner of the accumulated logs. A lien on these logs shall exist for the payment of these costs. If any person floating timber or logs shall permit damage by such logs to be done to a bridge at public expense, he shall be liable therefor. Damages may be recovered by suit against him and the logs causing the damage may be seized and sold therefor. (Schram-Florida)
W70-00950

BRIDGES - BOUNDARY AND OTHER WATERS.
Miss Code Ann secs 8435 - 8447 (1956).

Descriptors: *Mississippi, *Bridge construction, *Boundaries (Property), *Bridges, Construction costs, Engineering structures, Administrative agencies, State governments, Federal government, Condemnation, Costs, Easements, Legal aspects, Eminent domain, Land tenure, Legislation, Damages, Financing, Local governments, Cities.

Any municipality or county or the State Highway Commission may construct and maintain toll or free bridges and approaches thereto. The bridges may extend over any bodies of water forming boundaries of the state. Funding of bridge construction may be accomplished by bonds. Municipalities may operate under this title by ordinance or resolution without necessity of charter amendment. Where a contemplated bridge construction will be connected to the public highway system, the State Highway Commission may contribute to the cost of construction or maintenance. Public agencies may purchase or acquire by condemnation such lands or servitudes needed for bridge construction. Public agencies of adjoining states may operate under this act in construction and maintenance of bridges across Mississippi boundaries. Any municipality or other public body may secure federal funds or other assistance through government contracts. These contracts may be entered into by ordinance or resolution. (Kelly-Florida)
W70-00951

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00952

SWAMP LAND DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00953

FLOOD CONTROL - DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 04A.
W70-00954

TOMBIGBEE RIVER VALLEY WATER MANAGEMENT DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00955

TOMBIGBEE RIVER VALLEY WATER MANAGEMENT DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00956

TOMBIGBEE RIVER VALLEY WATER MANAGEMENT DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00957

PAT HARRISON WATERWAY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00958

PAT HARRISON WATERWAY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00959

PAT HARRISON WATERWAY DISTRICT.
For primary bibliographic entry see Field 05G.
W70-00960

BIG BLACK RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00961

BIG BLACK RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00962

BIG BLACK RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00963

LOWER YAZOO RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00964

LOWER YAZOO RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00965

LOWER YAZOO RIVER BASIN DISTRICT.
For primary bibliographic entry see Field 04A.
W70-00966

SEA FOODS.
Miss Code Ann secs 6047-01 thru 6047-04, 6047-06, 6047-10 thru 6047-13, 6047-17, 6047-18, and 6051.5 (Supp 1968).

Descriptors: *Mississippi, *Fish conservation, *Marine fish, *Gulf of Mexico, Saline water fish, Commercial fishing, Commercial shellfish, Legislation, Saline water, Freshwater interfaces, Administrative agencies, Decision making, Leases, Rent, Permits, Oysters, Clams, Shrimp, Shellfish, Taxes, Tax rate, Canneries.

The public policy of Mississippi as to sea food laws is expressed. All of the wild aquatic life found in the waters of the State, until legally taken, is the property of the State. The Marine Conservation Commission is established to manage, control, supervise, and direct any matters pertaining to salt-water aquatic life. The organization of the commission, its members, and their compensation are outlined. The jurisdiction, authority, and duties of the commission are expressly provided. Generally, this empowers them to regulate all types of sea food except menhaden, trash fish, tuna, and red snapper. The rights of riparian owners on the Gulf Coast are defined. The commission is granted authority to lease the bottoms within its jurisdiction upon certain terms and conditions. The justices of the peace of the various counties are given jurisdiction over any prosecution or suit brought under this act. General penalties for violation of the provisions of this act are detailed. The commission is authorized and directed to assess and collect various licenses and taxes. The commission is also authorized to enter into an agreement for jurisdictional purposes as to the dividing line between salt and fresh waters. (Schram-Florida)
W70-00967

SEA FOODS.
Miss Code Ann secs 6047-01 thru 6047-04, 6047-06 (Supp 1968).

Descriptors: *Mississippi, *Fish, *Oysters, *Clams, Marine fish, Shellfish, Shrimp, Legislation, Fish conservation, Wildlife conservation, Saline water fish, Aquatic life, Reefs, Oceans, Gulf of Mexico, Marine fisheries, Commercial shellfish, Commercial fishing, Administrative agencies, Decision making.
Identifiers: *Sea foods, Propagation of marine life, Tonging reefs.

The public policy of the State is to recognize the need for a concerted effort to work toward the protection, propagation, and conservation of its sea food and aquatic life. All wild aquatic life existing in the waters of the State, including shell fish, are the property of the State until legally divested in the manner described herein. The Marine Conservation Commission is created and has the full power to manage, control, supervise, and direct any matters pertaining to saltwater aquatic life. The Commission shall be made up of ten members appointed by the governor with the qualifications herein. The Commission has authority over the taking, catching, and processing of shrimp, oysters, and crabs, but not over trash fish, menhaden, tuna, and red snapper. The Commission shall: (1) set standards of measure; (2) regulate fishing seasons; (3) set size, catching, and culling regulations; (4) set forth enforcement procedures and penalties for violation; (5) enter into advantageous interstate and intrastate agreements; (6) enact all ordinances necessary for the protection, conservation, or propagation of shrimp, oysters, and crabs; and (7) aid in the construction of canals to bring water to existing oyster reefs or beds. (Schram-Florida)
W70-00968

SEA FOODS.

Miss Code Ann secs 6047-10 thru 6047-13, 6047-17, 6047-18, 6051.5 (Supp 1968).

Descriptors: *Mississippi, *Riparian rights, *Oysters, *Saline water fish, Taxes, Tax rate, Assessments, Commercial fishing, Shellfish, Saline water, Freshwater interfaces, Gulf of Mexico, Leases, Rent, Permits, Shrimp, Canneries, Legislation, Fish conservation, Commercial shellfish.

The sole right of planting and gathering oysters in front of land bordering the Gulf of Mexico or Mississippi Sound belongs to the riparian owner and extends not more than 750 yards from the shore. The commission is granted authority to lease the bottoms within its jurisdiction upon certain conditions. These include: (1) lessees shall be residents of Mississippi; (2) leases must be for from five to one hundred acres; (3) applications for leases shall be considered in the order which they are filed; (4) rental shall be from one to five dollars per acre; and (5) all leases shall be subject to the paramount right of the state. The justices of the peace of the various counties shall have original jurisdiction over all prosecutions and suits brought under this act. A series of penalties for violations of this act are provided. The commission is authorized and directed to assess and collect taxes and licenses from (1) vessels catching, carrying, or transporting fish or oysters; (2) factories canning fish or oysters; (3) inspection fees; and (4) buyers or handlers of sea food. A provision for an agreement for jurisdictional purposes as to the dividing line between salt and fresh waters is provided. (Schram-Florida)
W70-00969

SEA FOODS: OYSTERS.
Miss Code Ann secs 6072, 6075-12, 6077, 6085-01, 6085-11 (Supp 1968).

Descriptors: *Mississippi, *Oysters, *Commercial shellfish, *Regulation, Fish harvest, Dredging, Inspection, Shellfish, Legislation, Administrative agencies, Local governments, Fish stocking, Fishing, Gulf of Mexico.

By order of the Seafood Commission, the Chief Inspector shall cultivate and improve the oyster beds under the control of the state of Mississippi. He may relocate oysters, spend funds for propagation, and advise the Commission of suitable sites for new beds. The Commission may prohibit taking oysters from areas where the water is impure or liable to be harmful to oysters. In certain areas dredging for oysters is prohibited, and no one may take oysters by any means after dark. Any municipality bounding on the Gulf of Mexico, which has an oyster bed within its corporate limits, may aid in enforcing the oyster laws of this state. (Darragh-Florida)
W70-00970

WESTPHAL V SCHMALZ (UNAUTHORIZED USE OF DRAINAGE SYSTEM).
For primary bibliographic entry see Field 04A.
W70-00971

BRYANT V PEPPE (ESTOPPEL TO ASSERT TITLE WHEN LAND CHANGED BY AVULSION).
226 So2d 357-358 (2d DCA Fla 1969).

Descriptors: *Florida, *Avulsion, Judicial decisions, Boundaries (Property), Shores, Assessments, Taxes, Accretion (Legal aspects).

Appellee's land was formerly separated from the Gulf of Mexico by land on the west which was obliterated by avulsion. The owners were denied a decree quieting title to the land now fronting on the Gulf because title was held to be in the state. The court has declared that avulsion precludes attainment of title by the private owners of adjoining property by accretion, but in this case the state was estopped from claiming title. The predecessor in title had successfully defended his possessory right to the Gulf frontage in an action upheld by the Supreme Court. The tax assessor assessed the property as fronting on the Gulf for many years, and the state did not offer to do equity for the overcharge if the state was found to be the owner. The state's treatment of public property as property of private citizens may result in the loss of it. (Douberley-Florida)
W70-00972

CONDEMNATION BY CITIES AND COUNTIES TO PROVIDE WATERSHEDS OR BEDS FOR WATER PIPES.
For primary bibliographic entry see Field 04A.
W70-00973

INSPECTION DISTRICTS; POLICE FLEET.
Va Code Ann secs 28.1-37 thru 28.1-46 (1969).

Descriptors: *Virginia, *Fishing, *Administrative agencies, *Commercial fishing, Commercial shellfish, Regulation, Administration, State jurisdiction, Legal aspects, Legislation, Permits, Boats, Inspection, Control, Surveys, Taxes.

The Commission of Marine Resources shall create inspection districts within its jurisdiction. The number of districts should be the smallest possible commensurate with the efficient enforcement of fish and shellfish laws. The Commission shall appoint chief inspectors and inspectors for each district. The Commission shall also designate officials in each district to collect fees for services and issuance of licenses. Inspectors are responsible for collection reports. The police fleet consists of the boats now operated by the Commission and may be enlarged in accordance with special law or general powers conferred by law. (Kelly-Florida)
W70-00974

FISH AND FISHING GENERALLY: FISH FOR MANUFACTURE INTO FISH MEAL, OIL.
Va Code Ann secs 28.1-58 thru 28.1-66 (1969).

Descriptors: *Virginia, *Commercial fishing, *Permits, Administrative agencies, Administration, Taxes, Commercial fish, Regulation, Reasonable use, Fish management, Fish conservation, Inspections, State jurisdiction, State governments, Tidal waters, Legislation, Legal aspects, Fish.
Identifiers: Penalties (Criminal), Purse nets, Fish meal, Fish oil.

Food fish may not be taken for use in manufacture of fish meal or oil. One percent of a catch used for this purpose may consist of food fish, but only if all living food fish found in the net are immediately released. Violation of this provision is a misdemeanor. Those persons or corporations desiring to fish with purse nets for fish to be used in manufacture of fish meal, scraps, or oil must procure a license. The amount of the license tax depends upon the type and size of the operation. Except for taking 'menhaden' fish, no non-resident will be licensed to catch fish for meal or oil manufacture in the waters of the state. The Commissioner of Marine Resources shall make final approval of license applications, subject to judicial appeal to the appropriate circuit court. Violation of this title will result in prosecution for a misdemeanor and forfeiture of any vessel and/or tackle used in the violation. Non-residents may be stockholders or employees of domestic corporations engaged in the fishing herein described. (Kelly-Florida)
W70-00975

FISH AND FISHING GENERALLY: TROLLS, TRAWL NETS, AND DRAG NETS.

Va Code Ann secs 28.1-67 thru 28.1-72.1 (1969).

Descriptors: *Virginia, *Commercial fishing, *Commercial fish, *Nets, Regulation, Trawling,

Productivity, Tidewaters, State jurisdiction, State governments, Fishing, Legislation, Legal aspects, Permits, Ships, Boats, Administration, Administrative agencies.
Identifiers: Trawl nets, Drag nets.

Use of a troll or trawl net, drag net or similar device drawn through the water by a vessel for the purpose of taking fish is prohibited. Purchase or sale of fish taken in this manner is also prohibited. The Commissioner of Fisheries may issue licenses for trawl fishing in specific areas during certain months. Otherwise, the finding of any vessel equipped for trawling or trolling is prima facie evidence of a violation of the statute. Any vessels used in the violation of the statute, together with tackle and cargo shall be forfeited to the state. Nothing in the statute prohibits the lawful transportation of fish caught outside the state jurisdiction into Virginia ports to be marketed. (Kelly-Florida)
W70-00976

FISH AND FISHING GENERALLY: MARKING OF BOATS, NETS, AND OTHER DEVICES.

Va Code Ann secs 28.1-73 thru 28.1-81 (1969).

Descriptors: *Virginia, *Commercial fishing, *Permits, *Administrative agencies, Commercial fish, Boats, Ships, Fish management, Fish conservation, Fish, Tidal waters, Nets, Inspections, Control, Regulation, State jurisdiction, State governments, Taxes.

The Commissioner of Marine Resources is obligated to provide license tags where required by statute or regulation. The inspectors furnish these tags to licensees upon payment of license taxes, and the tags must be prominently displayed. Tags for certain fishing devices are required. Any person employing a fishing device which requires the use of poles or stakes must remove all abandoned stakes, save one which can be left as an identification marker. The Commission may revoke the fishing licenses of those who fail to comply. Fishing in certain waters is prohibited. (Kelly-Florida)
W70-00977

TAKING OYSTERS GENERALLY.
Va Code Ann 28.1-82 thru 28.1-85 (1969).

Descriptors: *Virginia, *Oysters, *Commercial shellfish, *Shellfish, Reasonable use, State jurisdiction, Tidal waters, Fish conservation, Permits, Legislation, Legal aspects, Clams, Commercial fish, Commercial fishing, Regulation, Administrative agencies, State governments, Administration, Fishing, Control.
Identifiers: Oyster seasons, Oyster tongs, Natural oyster beds, Oyster seed beds.

Seasons are established for the taking of oysters from natural or public oyster beds, rocks, or shoals in the waters of the state. The length of the season varies with the location and with the fishing method used. The finding of any person possessing patent tongs or shaft tongs upon the public or natural oyster beds or shoals, at times other than those specified, is prima facie evidence of violation of this statute. No one may use patent tongs for catching oysters from natural beds in certain specified areas. The Commission may close or open any area, or restrict the manner of taking oysters in public or natural rocks, grounds or shoals, in order to protect and promote the growth of oysters. The Commission may establish seed beds and plant shells or take any other restorative measures it deems necessary. Closing of areas may be for any period, provided that notice is given. Reopening of oystering grounds need not be accompanied by notice. (Kelly-Florida)
W70-00978

OYSTER RECORDS AND TAXES.

Va Code Ann secs 28.1-87 thru 28.1-95 (1969).

Descriptors: *Virginia, *Oysters, *Taxes, *Commercial shellfish, Shellfish, State jurisdiction, Fish conservation, Permits, Legislation, Legal aspects, Commercial fishing, Regulation, Administrative agencies, Administration, Assessments, Costs, Tax rate, Tariff, Government finance, Financing, Inspection.
Identifiers: *Oyster replenishment, Oyster dealers, Oyster buyers, Oyster planting, Seed oysters.

Designated commercial oyster dealers are required to keep daily records of oysters packed or marketed by them. They must pay a specified tax on each bushel of oysters taken; the tax is to be collected by the district inspector or a police boat captain. The Commissioner or any inspector may examine any oysters taken or purchased as to quality or quantity. Persons purchasing oysters from those catching or taking oysters from public rocks, beds, or shoals must have an oyster buyer's license issued by the Commission of Marine Resources. Oyster buyers must also submit records of purchases to the Commission. All oyster replenishment taxes, collected on each purchase of oysters, are deposited in the Public Oyster Rocks Replenishment Fund, to be used for replenishment, planting, and replanting the public oyster rocks, beds, and shoals within the state jurisdiction with seed oysters, oyster shells, or other material to catch, support, and grow oysters. The Commissioner may contract with private persons or firms in carrying out the replenishment. (Kelly-Florida)
W70-00979

CARRYING OYSTERS FROM STATE OR CERTAIN GROUNDS.

Va Code Ann secs 28.1-96 thru 28.1-99 (1969).

Descriptors: *Virginia, *Oysters, *Permits, *Commercial shellfish, State jurisdiction, Fish conservation, Legislation, Legal aspects, Regulation, Reasonable use, Administration, Administrative agencies, Commercial fishing, Shellfish, Conservation, Fish management, Taxes.
Identifiers: Oyster seed areas.

Permits issued by the Commission of Marine Resources must be obtained before anyone may transport oysters out of the state. A tax on each bushel must be paid before a permit will be issued. The Commission is obligated to issue these permits unless, after examination of the seed areas, it is ascertained that removal would either deplete or injure the seed areas or render the remaining supply insufficient to meet residents' demands. State residents must obtain a permit before removing oysters from certain areas as well as before planting them within the state. (Kelly-Florida)
W70-00980

LICENSING OF STATIONARY AND FLOATING DUCK BLINDS.

Va Code Ann secs 29-83 thru 29-87, 29-90 (1969).

Descriptors: *Virginia, *Permits, *Riparian rights, *Administrative agencies, Hunting, Water-fowl, Migratory birds, Shores, Conservation, Wildlife conservation, Recreation, Legal aspects, Water utilization, Regulation, Control, Public rights.
Identifiers: Duck blinds, Trespass, Penalties (Criminal), Public waters.

Floating duck blinds must be licensed and may be anchored no closer than 500 yards to a stationary blind or other licensed floating blind. Fees for licenses for blinds are based on the type of blind, and licenses are issued between July 1 and October 31 of each year. Riparians have the exclusive privilege of licensing and erecting blinds on their shore and in the public waters in front of such shore, if licenses are obtained between July 1 and August 31. If such blinds are erected and tagged, no other stationary or floating blind may be located within 500 yards without the consent of the riparian or his lessee or permittee. The riparian's failure to exercise this privilege within the stated period allows other persons to erect and license blinds in the offshore waters. Hunting from a boat, float, or raft other than a licensed blind within 500 yards of a licensed blind constitutes a trespass to the licensed blind. Violation of licensing and hunting provisions are a misdemeanor. (McDonough-Florida)
W70-00981

FISHING PERMITS; NATIONAL FORESTS.

Va Code Ann secs 29-108, 29-110, 29-114.1, 29-117 thru 29-120 (1969).

Descriptors: *Virginia, *Permits, *Fish management, *Fish conservation, Legislation, Legal aspects, Regulation, Fish, Rainbow trout, Brook trout, Fish reproduction, National forests, Natural resources, Administrative agencies, Federal government, Nets, Fyke nets, Gill nets, Financing, Sport fish, Wildlife management, Wildlife conservation, Fish farming, Fish hatcheries, Reproduction.
Identifiers: Licenses, Fish propagation.

The fee for a permit to breed and artificially raise rainbow trout and brook trout for sale from a privately owned hatchery is five dollars. The fees for permits to net certain species of fish by specified methods are established. The Commission is authorized to issue permits to private fish pond owners to sell game fish therefrom for propagation only. No person may fish in the national forests within the state without first obtaining, in addition to the regular resident or non resident license, a special permit at the cost of one dollar. Revenue from the sale of special permits will be used by the Commission for wildlife management purposes in the national forests within the state, or in the discretion of the Commission such revenue may be paid into the United States treasury for use of the United States Forest Service for wildlife management purposes in the national forests within the state. The Commission will enter into a cooperative agreement with the United States Forest Service to define ways to improve the wildlife resources of the national forests within the state and to program the expenditure of funds derived from special permit sales. (Keith-Florida)
W70-00982

THE TAKING OF MINERALS FROM BEDS AND NAVIGATION.

Va Code Ann secs 62.1-4 thru 62.1-9 (1968).

Descriptors: *Virginia, *Minerology, *Navigation, *Obstruction to flow, Legislation, Legal aspects, Administrative agencies, Regulation, Easements, Leases, Beds, Royalties, Fishing, Oysters, Shellfish, Dredging, Drilling, Wildlife conservation, Watercourses (Legal), Dams, Barriers, Mining, Dam construction, Relative rights, Ownership of beds.
Identifiers: *Marine resources, *Shells.

The Marine Resources Commission may grant easements in and leases to the beds of state waters. The terms of such easements and leases will specify the rent royalties and other proper terms. Such easements and leases may authorize the grantees and lessees to take oil, gas, and such other minerals as are therein specified, provided no such talking will interfere with the public rights of fishing, fowling, and oystering. The Commission of Game and Inland Fisheries is empowered to regulate drilling, dredging, or other operations designed to obtain shells or minerals in specified beds in order to prevent harm to wildlife. The circuit court of any county may contract to have obstructions removed from any watercourse within its jurisdiction. Any previous act granting the power to abate or remove dams or other works or to improve navigation is declared valid. The water use rights of the state or any company incorporated for navigation improvement will not be affected by any court order granting any person permission to obstruct any watercourse. Courts will not in the future issue any order which will result in an obstruction to navigation. (Keith-Florida)

W70-00983

STATE POLICY AS TO WATERS.

Va Code Ann secs 62.1-11 thru 62.1-13 (1968).

Descriptors: *Virginia, *Water resources, *Water conservation, *Public benefits, Legislation, Legal aspects, Regulation, Natural resources, Streams, Lakes, State jurisdiction, Water resources development, Watercourses (Legal), Contracts, Cities, Reasonable use, Public rights, Local governments, Water utilization, Usufructuary right.
Identifiers: *Policy.

The waters of the state are a natural resource which should be regulated by the state. The regulation, control, development, and use of waters for all purposes beneficial to the public are within the jurisdiction of the state which may establish measures to effectuate the proper utilization and protection of such waters. The needs of the people may require state water resources to be put to public uses. The waste or unreasonable use of water should be prevented, and the conservation of water is to be exercised with a view to the public welfare. The public welfare requires the proper development, wise use, conservation, and protection of water resources. The right to the use of water or to the flow of water in or from any natural stream, lake, or other watercourse is limited to such water as may be required for the public use. Nothing in this act will operate to affect any valid use of the waters of the state, nor will it be construed as applying to the determination of rights in any proceeding. The purpose of this act is to recognize the public use to which water is devoted, and the act will not divest any governmental unit of any rights or responsibilities. (Keith-Florida)
W70-00984

TAKING OF SEAWEED BY INHABITANTS OF BARRINGTON.

RI Gen Laws Ann secs 46-11-1 thru 46-11-3 (1956).

Descriptors: *Rhode Island, *Aquatic weeds, *Beaches, *Riparian plants, Consumptive use, Weeds, Seashores, Shores, Oceans, Relative rights, Vegetation, Crop production, Plants.
Identifiers: *Seaweed, Penalties (Criminal).

The inhabitants of the town of Barrington may, between sunrise and sunset, take seaweed from the public beach at Barrington. Each person shall be limited to two cart or wagon loads in one day. However, no person shall take more than one load until all others taking seaweed shall have obtained one load each. This privilege is restricted to Barrington inhabitants. Persons violating this act shall forfeit ten dollars for each load of seaweed carried off. (Marsee-Florida)
W70-00985

FISHING IN INTERSTATE NONTIDAL WATERS.

Va Code Ann secs 29-153.1, 29-153.2 (1969).

Descriptors: *Virginia, *Sport fishing, *Interstate compacts, *Permits, Legislation, Legal aspects, Fish, Fishing, Regulation, Administrative agencies, Wildlife management, Fish conservation, Water law, Interstate, Control, Water utilization.
Identifiers: *Nontidal waters, *Interstate waters, *Reciprocal agreements, Penalties (Criminal).

It is lawful for citizens of Virginia and citizens of adjoining states which have nontidal water partly in such adjoining state and partly in Virginia to fish in such interstate nontidal waters; each citizen must comply with his own state's laws for taking fish in such waters. The Commission of Game and Inland Fisheries is empowered to enter into a reciprocal agreement with any state sharing interstate nontidal waters with Virginia relating to the following: (1) recognition of a resident sport fishing license acquired in an adjoining state when the licensee is fishing in such waters; and (2) strict observance of state creel limits, open seasons, and all other laws and regulations of the adjoining state. The failure of any person to comply with the rules established under such agreement will subject such person to criminal penalties. (Keith-Florida)
W70-01020

CLUBS, PRESERVES, AND NATIONAL FORESTS; COMPLIMENTARY LICENSES.

Va Code Ann secs 29-78 thru 29-80 (1969).

Descriptors: *Virginia, *Wildlife management, *Permits, *Wildlife conservation, Hunting, Fishing, Trapping, Administrative agencies, Conservation, Fish conservation, Forests, National forests, Public lands, Recreation.

All persons including those on the lands or waters of any public or private club must obtain a license before hunting, trapping, or fishing this state. A regular license, as well as a special permit, are required before any person may hunt, fish, or trap on any lands in the national forests in this state. The Commission of Game and Inland Fisheries may issue a limited number of complimentary hunting and fishing licenses to United States conservation officials. (McDonough-Florida)
W70-01021

STATEMENTS OF POLICY ON PUBLIC WATER SUPPLY MATTERS--AMERICAN WATER WORKS ASS'N PRINCIPLES OF NATIONAL WATER POLICY.
For primary bibliographic entry see Field 05G.
W70-01130

BASIC WATER USE DOCTRINES AND STATE WATER CONTROL AGENCIES.
For primary bibliographic entry see Field 04A.
W70-01131

HAS RECENT LEGISLATION LIMITED PRIVATE RIPARIAN RIGHTS IN IOWA,
For primary bibliographic entry see Field 03D.
W70-01133

APPROPRIATION WATER LAW ELEMENTS IN RIPARIAN DOCTRINE STATES,
J. H. Beuscher.
Buffalo L Rev, Vol 10, No 2, p 448-458, Winter 1961. 11 p, 48 ref.

Descriptors: *Appropriation, *Water rights, *Riparian rights, *Water policy, Prior appropriation, Preferences (Water rights), Priorities, Natural flow doctrine, Competing uses, Regulation, Relative rights, Water allocation (Policy), Water utilization, Consumptive use, Waste dilution, Water demand, Public utilities, Water distribution (Applied), Water management (Applied), Domestic water, Reasonable use, Artificial use, Industrial water, Irrigation water, Mill dams, Riparian land, Riparian waters, Usufructuary right, Waste disposal, Zoning, Local governments.

It is an overgeneralization to say that humid states apply the riparian doctrine. Legislation, administration and adjudication in many instances deal more with appropriation principles rather than with riparianism. This is seen in three areas: the precedence given to the reasonable use doctrine over the natural flow precept in many decisions; the preferred protection given to a prior user as against a subsequent water claimant; and the willingness of courts to allow water to be taken for non-riparian lands. Courts have qualified correlative co-sharing by granting prescriptive rights to an open, notorious, adverse user. The right to domestic use has been extended to include water taken by municipal utilities, a right that is often held to be superior to that of co-riparians. The riparian who is first to construct a mill dam has been granted appropriative status, often to the complete destruction of natural flow. Downstream riparians are treated as inferior to upstream riparian polluters, and many states give preferences to industrial users. Local governments can restrict the use of water by riparians by zoning the riparian land, thus disrupting co-sharing equality among riparians. A description of riparian water laws is a difficult task. (Douberley-Florida)
W70-01134

CIVIL LAW PROPERTY--ENCROACHMENTS ON RIVER BANKS BY RIPARIAN OWNERS,
For primary bibliographic entry see Field 04C.
W70-01135

THE FEDERAL GOVERNMENT AND AIR AND WATER POLLUTION,
For primary bibliographic entry see Field 05G.
W70-01136

ACQUISITION OF THE RIGHT TO USE WATER,
Ewell P. Walther, Jr.
Tul L Rev, Vol 29, No 3, p 554-565, Apr 1955. 12 p, 123 ref.

Descriptors: *Water rights, *Water users, *Riparian rights, *Prior appropriation, Natural flow doctrine, Judicial decisions, Reasonable use, Legislation, Louisiana, Legal aspects, Water law, Water pollution, Subsurface waters, Relative rights, Water utilization, Usufructuary right.
Identifiers: Common law, Acquisition.

Water rights may be acquired in several ways. Generally, states east of the Mississippi employ the common law riparian rights doctrine, and western states adhere to the doctrine of prior appropriation either in conjunction with or exclusive of the doctrine of riparian rights. Water rights may also be acquired by contract and by prescription. Under the common law of riparian rights two theories have developed - the natural flow theory and the reasonable use doctrine. Both theories are defined herein. Under the prior appropriation doctrine, which the author favors, the first appropriator in time gains a superior right. All public waters are subject to appropriation. Many variations have been developed by legislation. Complex problems have arisen in western states utilizing both the riparian rights and prior appropriation doctrines. In these states, a riparian proprietor may choose either but not both of these theories. Both riparian and appropriative water rights may be acquired by prescription. Water rights in Louisiana are somewhat unsettled, but judicial decisions seem to look to the common law. (Heckerling-Florida)
W70-01137

WISCONSIN LAW OF WATERS,
For primary bibliographic entry see Field 04A.
W70-01138

RIPARIAN WATER RIGHTS V A PRIOR APPROPRIATION SYSTEM: A COMPARISON,
For primary bibliographic entry see Field 06B.
W70-01139

RIPARIAN WATERS RIGHTS V A PRIOR APPROPRIATION SYSTEM: A COMPARISON,
For primary bibliographic entry see Field 06B.
W70-01140

RIPARIAN WATER RIGHTS V A PRIOR APPROPRIATION SYSTEM: A COMPARISON,
For primary bibliographic entry see Field 06B.
W70-01141

RIPARIAN WATER RIGHTS V A PRIOR APPROPRIATION SYSTEM: A COMPARISON,
For primary bibliographic entry see Field 06B.
W70-01142

THE NAVIGATION SERVITUDE AND JUST COMPENSATION: STRUGGLE FOR A DOCTRINE,
For primary bibliographic entry see Field 04A.
W70-01144

THE NAVIGATION SERVITUDE AND JUST COMPENSATION: STRUGGLE FOR A DOCTRINE,
For primary bibliographic entry see Field 04A.
W70-01145

STOUDER V DASHNER (DOMINANT VERSUS SERVIENT LAND RIGHTS RELATING TO DRAINAGE OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
W70-01146

ROCKLAND COUNTY ANTI-RESERVOIR ASS'N V DURYEA (PREVENTION OF RESERVOIR CONSTRUCTION).
For primary bibliographic entry see Field 04A.
W70-01147

FISH (LICENSES AND PERMITS).

Ill Ann Stat ch 56, secs 225-242 (Smith-Hurd 1967), as amended, (Supp 1969).

Descriptors: *Illinois, *Regulation, *Fish, *Permits, Legislation, Commercial fishing, Sport fishing, Fishing gear, Mussels, State jurisdiction, State governments, Administrative agencies, Control, Legal aspects, Interstate compacts.

Fishing licenses are issued only upon application. Penalties are provided for violation of this provision. Fees for resident and non-resident licenses are set. The Department of Conservation may enter into reciprocal fishing agreements with Missouri, Iowa, and Indiana to permit persons licensed by these states to fish in any of the running waters forming a boundary between such states and Illinois. Resident retail fish dealers and wholesale dealers must procure a license. All licenses issued to retail fish dealers are valid only in the location described on the license application. To catch mussels and to engage in fish taxidermy also requires a license, as does the breeding of fish. Any person who desires to establish a fee fishing pond must apply for a license. The holder of the license must require all fishermen in such pond to register daily. Permits for the collection of fish for scientific purposes are granted. (Moulder-Florida)
W70-01148

OFFENSES AGAINST PROPERTY BY FORCE.
Ky Rev Stat Ann sec 433.330 - 433.360, 433.410, 433.710, 433.760, 433.780, 433.757 (1963), as amended, (Supp 1968).

Descriptors: *Kentucky, *Damages, *Water pollution control, *Regulation, Bridges, Levees, Railroads, Fish, Fishing, Navigation, Dams, Locks, Reservoirs, Legislation, Drainage, Sewers, Boats, Pollution abatement.

Anyone obstructing, damaging, or destroying any salt works, levee, state operated bridge or ferry, railway lock, or dam shall be subject to imprisonment in the state penitentiary. Any person who fishes, disturbs, or destroys a private fish pond shall be punished criminally and shall be liable for treble damages. Anyone who destroys public property shall be criminally liable for a fine. Anyone operating as a residence any boat or shanty who ties up to private property without permission shall be subject to fine and imprisonment. Any person who litters or dumps refuse upon public waters shall be subject to a fine. (Darragh-Florida)
W70-01149

JURISDICTION OF COUNTY DRAINAGE BOARDS.
For primary bibliographic entry see Field 04A.
W70-01150

OBSTRUCTION AND POLLUTION OF WATERS.
For primary bibliographic entry see Field 05G.
W70-01151

CONSTRUCTION, OPERATION, AND MAINTENANCE OF TOLL BRIDGES OVER PEARL RIVER.
Miss Code Ann secs 8447-51 thru 8447-68 (Supp 1968).

Descriptors: *Mississippi, *Bridges, *Local governments, *Bridge construction, Financing, State governments, Legislation, Legal aspects, Right-of-way, Easements, Condemnation, Eminent domain, Riparian lands, Beds under water, Federal government, Construction costs, Bridge design.

The legislature has declared that construction of additional bridges across the flood plain of the Pearl River will promote the economic development of the state, and the general welfare of the people. Any county bordering on the Pearl River is authorized to construct and maintain toll bridges across the river and/or its flood plain. The county may issue bridge revenue bonds to defer costs, may act jointly with other counties, and may enter agreements with federal or other governing agencies to further construction or financing. The county engaged in construction of a bridge under this act may purchase such lands, rights-of-way, easements in lands under water, and riparian lands or may acquire such lands and servitudes by eminent domain. (Kelly-Florida)
W70-01152

FLOOD CONTROL.
For primary bibliographic entry see Field 04A.
W70-01153

SILVER BLUE LAKES APARTMENTS V SILVER BLUE LAKE HOME OWNERS ASS'N INC (UNREASONABLE USE OF ARTIFICIAL WATERBODY).
For primary bibliographic entry see Field 04A.
W70-01154

NEW JERSEY TURNPIKE AUTHORITY V SISSELMAN (CONDEMNATION OF RIPARIAN LAND).
106 NJ Super 358, 255 A2d 810-817 (1969).

Descriptors: *New Jersey, *Condemnation, *Bridge construction, *Riparian land, Judicial decisions, Legislation, Federal government, Rivers and Harbors Act, Canals, Highways, State governments, Administrative agencies, Projects.

Plaintiffs brought suit to have certain property owned by defendant condemned in the public interest so that a highway spur might be built from the existing turnpike. The project was expressly authorized by the legislature. Defendant contended that the taking violated the Federal Harbors and Rivers Act and that the Authority had failed to comply with the requirements of a state statute. The land in question was needed for the construction of two bridges over a canal. Under the federal act any construction must be approved by the Corps of Engineers. The Turnpike Authority had applied for approval but had not received it when construction on the bridges began. Under the state statute, any public project must be referred to a planning board for review which the Authority failed to do. After reviewing the statutes the court upheld the denial of an injunction against the condemnation by the Authority. The court held that the Authority had complied with both statutes. Under the federal act, since no construction had begun on an unapproved bridge, the statute had not been violated. The court also held that the state statute did not apply once the legislature had authorized the project. (Heckerling-Florida)
W70-01155

WATER RESOURCES.
For primary bibliographic entry see Field 04B.
W70-01156

PEARL RIVER BASIN DEVELOPMENT DISTRICT ACT.
For primary bibliographic entry see Field 06B.
W70-01157

PEARL RIVER BASIN DEVELOPMENT DISTRICT ACT.
For primary bibliographic entry see Field 06B.
W70-01158

PEARL RIVER BASIN DEVELOPMENT ACT.
For primary bibliographic entry see Field 06B.
W70-01159

FISHING, HUNTING, TRAPPING PERMITS.
Va Code Ann secs 29-51 thru 29-53, 29-55 thru 29-55.2, 29-55.4, 29-57 thru 29-60, 29-77.1 (1969).

Descriptors: *Virginia, *Permits, *Administrative agencies, *Wildlife management, Legislation, Hunting, Fishing, Trapping, National parks, Fish stocking, Fisheries, Fish conservation, Wildlife conservation, Recreation, Regulation, Legal aspects.
Identifiers: Licenses.

All persons must have permits to hunt, fish, or trap in this state, except that no permit is required for landowners on their own lands, residents under sixteen or over seventy on private lands in the county of residence, or Indians residing on reservations. Permits are available to state residents, landowners with at least four months residence, members of the armed forces in this state, and students in preparatory schools, colleges, or universities in this state. Non-residents must purchase a non-resident license. Special licenses are required to fish in waters stocked by the Commission of Game and Inland Fisheries and in the waters of the Shenandoah National Park and the Blue Ridge Parkway. Holders of trip fishing permits cannot fish in trout streams or waters stocked by the Commission. (McDonough-Florida)
W70-01160

FISH, OYSTERS, SHELLFISH, AND OTHER MARINE LIFE: MARINE RESOURCES COMMISSION AND COMMISSIONER OF MARINE RESOURCES.
For primary bibliographic entry see Field 03E.
W70-01161

MARINE RESOURCES COMMISSION.
For primary bibliographic entry see Field 03E.
W70-01162

SURVEYS OF AND RIGHTS IN OYSTER GROUNDS.
For primary bibliographic entry see Field 03E.
W70-01163

LEASING OYSTER-PLANTING GROUNDS.
For primary bibliographic entry see Field 03E.
W70-01164

TRANSFER OF OYSTER-PLANTING LEASES; RIGHTS OF RIPARIANS.
For primary bibliographic entry see Field 03E.
W70-01165

CULLING OYSTERS.
For primary bibliographic entry see Field 03E.
W70-01166

FISH LAWS.

Va Code Ann secs 29-148 thru 29-153 (1969).

Descriptors: *Virginia, *Fish, *Fish management, *Fishing, Legislation, Legal aspects, Regulation, Herrings, Mullets, Bass, Trout, Perches, Streams, Rivers, Fish reproduction, Fish conservation, Dams, Fish ladders, Watercourses (Legal), Fish barriers, Navigation, Water pollution, Damages, Fish stocking, Fish hatcheries, Administrative agencies.
Identifiers: *Inland waters, *Fish wheels, *Game fish, Shad, Penalties (Criminal).

Until otherwise provided by a regulation of the Commission of Game and Inland Fisheries, it shall be unlawful for any person to take any fish in inland waters other than shad, herring, or mullet except by fishing with a hook and line or rod and reel. It is likewise unlawful to possess any species of bass or trout except as specifically provided. It is lawful to sell trout which have been propagated and raised in a hatchery. The open season during which it will be lawful to take bass and trout by specified lawful methods will be as promulgated by Commission regulations. Owners and lessees of private ponds may take fish therefrom for personal use at any time. Any dam or other barrier in a watercourse which obstructs navigation or the passage of fish will be deemed a nuisance unless useful to the public and permitted by law or court order. Owners of obstructions to the free passage of fish will provide such obstructions with fish ladders. Fish wheels may be operated in the ponds of this state for the purpose of restocking such ponds. It is unlawful, with specified exceptions, to use any substance for the destruction of fish or to place any noxious substance in any watercourse. (Keith-Florida)
W70-01167

OWNERSHIP OF BEDS.

Va Code Ann secs 62.1-1 thru 62.1-3 (1968).

Descriptors: *Virginia, *Beds, *Ownership of beds, *Riparian rights, Legislation, Legal aspects, Bays, Rivers, Shores, Jurisdiction, Fishing, Shellfish, Low water mark, Boundaries (Property), Maps, Dam construction, Navigation, Flood control, Erosion control, Sea walls, Jetties, Docks, Marinas, Easements, Permits, Leases, Surveys, Sewerage, Administrative agencies, Bulkhead line.
Identifiers: *Marine resources, *Riparian owners.

All of the unconveyed beds of bays, rivers, creeks, and the shores of the sea within the jurisdiction of the state will continue and remain the property of the state. Such beds, and shores may be used by the people of the state for fishing and the taking of shellfish, subject to state law. The limits or bounds of land lying on bays, rivers, creeks, and shores, and the rights and privileges of the owners of such land, will extend to low water mark only. An exception exists where a creek or river has been conveyed by a special grant or compact. It is unlawful to trespass or encroach upon or take or use any materials from the beds of bays, rivers, creeks, and sea shores which are state property without first obtaining authority from the Marine Resources Commission, except for: (1) authorized dam construction; (2) uses of beds authorized under different code provisions; (3) approved construction of navigation and flood control projects; (4) seawalls and jetties for erosion control; (5) docks and landings for non-commercial use; (6) fills by riparian owners to their established bulkhead line; (7) facilities for public use or facilities owned or operated by any public service corporation; and (8) other uses authorized by the state legislature. The method of obtaining special permission from the Marine Resources Commission is specified. (Keith-Florida)
W70-01168

GENERAL PROVISIONS OF THE STATE WATER CONTROL LAW.
For primary bibliographic entry see Field 05G.
W70-01169

POWERS AND DUTIES OF THE STATE WATER CONTROL BOARD.
For primary bibliographic entry see Field 05G.
W70-01170

REGULATION OF SEWAGE DISCHARGE.
For primary bibliographic entry see Field 05G.
W70-01171

PENALTIES FOR POLLUTION AND POLLUTION FROM BOATS.
For primary bibliographic entry see Field 05G.
W70-01172

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN.
For primary bibliographic entry see Field 05G.
W70-01173

OHIO RIVER VALLEY WATER SANITATION COMMISSION.
For primary bibliographic entry see Field 05G.
W70-01174

WATER-POWER DEVELOPMENT, CONSERVATION OF HYDROELECTRIC POWER DAMS AND WORKS.

Va Code Ann secs 62.1-80, 62.1-82, 62.1-83, 62.1-85, 62.1-90, 62.1-91, 62.1-95 (1968).

Descriptors: *Virginia, *Hydroelectric power, *Hydroelectric project licensing, *Dam construction, Hydroelectric plants, Electric power, Electric powerplants, Powerplants, Dams, Electric power industry, Electric power production, Water utilization, State governments, Federal government, Administrative agencies, Obstruction to flow, Navigable waters, Navigation, Regulation, Eminent domain, Riparian rights, Permits, River regulation.

The Water Power Act is to encourage water power development in Virginia. The State Corporation Commission controls and regulates such development. Nothing herein deprives any riparian owner of existing rights. No hydroelectric dam may be constructed across waters of the state unless such dam complies with the provisions of this Act. Persons proposing to construct dams must first obtain a license from the Commission. The Commission may reject license applications, require the modification of dam plans before issuing such license and may establish the terms and conditions thereof. Dams must not unreasonably obstruct navigation or stream flow, and where such dam is to be located across navigable waters of the United States the owner must make such provisions for navigation as are required by the Secretary of the Army. The value of a license must not be estimated in any valuation for rate making or for the acquisition by the state of property included in any licensed development. (Marsee-Florida)
W70-01175

RIGHT OF EMINENT DOMAIN OF PUBLIC SERVICE CORPORATIONS.
Va Code Ann sec 62.1-98 (1968).

Descriptors: *Virginia, *Eminent domain, *Riparian rights, *hydroelectric power, Condemnation, Compensation, Public utilities, Public lands, Dams, Reservoirs, Electric power production, Riparian land, Riparian waters, Flow, Highway relocation, Legislation, Legal aspects, Damages.
Identifiers: *Public service corporation.

Public service corporations producing hydroelectric power for public sale have the right of eminent domain. This right may be exercised to acquire all necessary lands, property, or rights including lands held for public or private, religious, charitable, educational, or cemetery purposes. Eminent domain is not available as against public-carrier railroads or any streets or alleys in municipalities. In the event of condemnation of roads or bridges, compensation and damages will include the cost of relocation and reconstruction. Riparian owners may be compensated for loss of water flow downstream caused by corporation facilities. (McDonough-Florida)
W70-01176

SURFACE RUNOFF AND FLOODWATER DIVERSION.
For primary bibliographic entry see Field 04A.
W70-01177

MILLS, DAMS, AND CERTAIN OTHER WORKS ON WATERCOURSES.
For primary bibliographic entry see Field 04A.
W70-01178

FEDERAL WATER RESOURCES DEVELOPMENT.
For primary bibliographic entry see Field 06B.
W70-01179

IMPROVEMENT OF NAVIGABILITY OF STREAMS.
For primary bibliographic entry see Field 04A.
W70-01180

DREDGING SAND AND GRAVEL AND MISCELLANEOUS OFFENSES (WATER POLLUTION)
For primary bibliographic entry see Field 05G.
W70-01181

DUTIES OF DIRECTOR OF PUBLIC WORKS.
For primary bibliographic entry see Field 04A.
W70-01182

CONSTRUCTION OF PORT FACILITIES.
For primary bibliographic entry see Field 04A.
W70-01183

OBSTRUCTIONS TO NAVIGATION.
For primary bibliographic entry see Field 04A.
W70-01184

STAKES AND BUOYS.

R I Gen Laws Ann secs 46-7-1 thru 46-7-6 (1956).

Descriptors: *Rhode Island, *Buoys, *Channels, *Navigation, Bays, Rivers, Legislation, Administrative agencies, State governments, Federal government, Legal aspects, Navigable rivers, Navigable waters, Admiralty, Lighthouses, Oceans, Warning systems, Governments.

The Director of Public Works shall accurately mark the channel of the Pawtucket River by erecting suitable stakes and buoys along the sides of said channel at the request of persons interested in the navigation of the River. Penalties are provided for the misuse of injury to such channel markers. The proper venue for such offenses is designated as well

as the statute of limitations on the bringing of such action. (MarseenFlorida)
W70-01185

RHODE ISLAND PILOTAGE REGULATION.
For primary bibliographic entry see Field 04A.
W70-01186

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01187

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01188

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01189

RHODE ISLAND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 06D.
W70-01190

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION.
For primary bibliographic entry see Field 05G.
W70-01191

WATER POWER AND RESOURCES.
For primary bibliographic entry see Field 06B.
W70-01192

SHELLFISH TRANSFER AND TAKING.
R I Gen Laws Ann secs 20-11-14 thru 20-11-19 1968.

Descriptors Rhode Island, Shellfish, Commercial shellfish, Fish harvest, Clams, Commercial fish, Public health, Aquiculture, Fish conservation, Water conservation, Legal aspects, Administrative agencies, Legislation, Fisheries, Fish management, Fishing gear, Regulation, Supervisory control-Power, Control.
Identifiers PenaltiesCriminal.

The Director of Natural Resources is authorized to transfer shellfish from uncertified state waters to approved areas. The Director may make regulations governing the reharvest of such shellfish after taking all necessary safeguard to insure their cleanliness. Those areas to which the shellfish are transferred must be marked out, and dredging or tonging on them except under the direction of the Director is prohibited. The costs of transferring shellfish shall be met through the sale of shellfish. The possession, taking, and sale of soft-shelled clams is regulated herein including minimum size limits. This Act provides penalties for the improper taking of transferred shellfish. Marsee-Florida
W70-01193

REGULATION OF LOBSTER FISHERIES.

R I Gen Laws Ann secs 20-12-1, 20-12-2, 20-12-6 thru 20-12-11 1968.

Descriptors Rhode Island, Lobsters, Commercial shellfish, Commercial fishing, Fish harvest, Regulation, Administrative agencies, Water conservation, Legal aspects, Legislation, State governments, Fisheries, Fish conservation, Crustaceans, Animals, Permits, Jurisdiction, Buoys.
Identifiers Lobster pots.

In regulating the taking of lobsters from waters within the jurisdiction of Rhode Island, this Act contains provisions relating to 1 license requirements for the taking of lobsters; 2 procedures and regulations for the issuance of licenses; 3 the power of the Department of Natural Resources to require of licensees reports on lobster taken; 4 the minimum size of lobsters taken; 5 the unlawfulness of possessing egg-bearing female lobsters; 6 the buoying of pots; 7 the marking of buoys, pots, and other contrivances; 8 the unauthorized raising of pots; and 9 the unlawfulness of mutilating uncooked lobsters. Marsee-Florida
W70-01194

REGULATION OF SCALLOP FISHERIES.

R I Gen Laws Ann secs 20-13-1 thru 20-13-7, 20-13-10 thru 20-13-13, 20-13-17 1968.

Descriptors Rhode Island, Shellfish, Commercial shellfish, Commercial fishing, Fishing, Fish harvest, Regulation, Legislation, Permits, Administrative agencies, Water conservation, Legal aspects, State governments, Aquiculture, Fisheries, Farm ponds, Fish reproduction, Fish management, Fish conservation, Water farming.
Identifiers Scallops.

In regulating the taking of scallops in Rhode Island waters, this Act contains provisions relating to 1 the taking of scallops at night; 2 maximum daily take without a license; 3 open and closed seasons; 4 the issuance of licenses for the taking of scallops; 5 the taking of scallops stranded on the shore; 6 the taking and possession of seed scallops; and 7 the sale of scallops during closed season. Ponds are designated in which only hand-drawn dredges or appliances may be used. The Director of Natural Resources, in order to insure the future of the scallop industry, is responsible for transplanting seed scallops from endangered areas to more favorable locations in the state. Marsee-Florida
W70-01195

6F. Nonstructural Alternatives

EVALUATION OF BENEFITS OF A FLOOD WARNING SYSTEM,
Carnegie-Mellon Univ., Pittsburgh, Pa.; Systems Planning Associates, Pittsburgh, Pa.; and Weather Bureau, Pittsburgh, Pa.
For primary bibliographic entry see Field 06B.
W70-00838

6G. Ecologic Impact of Water Development

CHALLENGES TO CREATIVE CONSERVATION,
Colorado State Univ., Fort Collins.
Robert E. Dils.
J Soil Water Conserv, Vol 24, No 2, p 44-47, Mar-Apr, 1969. 4 p.

Descriptors: *Conservation, *Natural resources, Environment, *Ecology, Recreation, Creativity, Landscaping, Environmental engineering, Social values, Land management, *Land resources, City planning.
Identifiers: Landscapes, Professional development.

Despite a knowledge revolution in the last decade, challenges in all disciplines, including conservation, are greater today than ever before. The challenges are social, personal, professional, and technical; they apply to the experienced conservationist and to the neophyte. Six challenges that conservationists must overcome if a better life is to be created are: (1) the need to create and re-create a quality environment; (2) the ecology of leisure; (3) conservation of citysheds (synonymous with megalopolis); (4) landscape creativity; (5) cooperation in conservation; and (6) bringing minority groups into conservation. Conservationists must not be stereotyped as reserved, dedicated, well-trained scientists who maintain the status quo. They must be interested, involved, and creative in every facet of their work. Today's college graduate is well equipped in terms of education; with the modern tools, dollars, and facilities at his disposal, he is far better qualified than his counterpart a generation or two ago to create a better life for all. (USBR)
W70-01081

07. RESOURCES DATA

7A. Network Design

MEASURING RAINFALL ON FOREST CATCHMENTS,
Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02B.
W70-00843

7B. Data Acquisition

SEASONAL VARIATION IN RAIN GAGE CATCH,
Agricultural Research Service, Cochocton, Ohio. Soil and Water Conservation Research Div.; and Weather Bureau, Akron, Ohio. Eastern Region.
For primary bibliographic entry see Field 02B.
W70-00854

USE OF MEMBRANE FILTERS IN GRAVIMETRIC ANALYSES OF PARTICULATE MATTER IN NATURAL WATERS,
Dartmouth Coll., Hanover, N. H.; and Yale Univ., New Haven, Conn.
John S. Eaton, Gene E. Likens, and F. H. Bormann.
Water Resources Res, Vol 5, No 5, p 1151-1156, Oct 1969. 6 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Filtration, *Analytical techniques, *Water analysis, *Gravimetric analysis, Weight, Adsorption, Drying, Temperature, Absorption.
Identifiers: Millipore filters.

The weights of membrane filters used in gravimetric analysis of water were significantly changed by electrostatic charge, leachable material within the filters, and absorption of atmospheric moisture. Millipore type HA filters lost an average of about 0.32% of their dry weight as leachable material when 6 liters of distilled water were filtered. About 165 ml were required to remove 50% of the total leachable material removed by 1000 ml. These filters absorbed moisture from the atmosphere very rapidly during the first minute of exposure and at a much slower rate thereafter. The leachable material contributed to moisture absorption. Desirable drying temperature and time for Millipore type HA filters was determined. Other filters were compared: recommendations for the use of these filters are given. (Knapp-USGS)
W70-00857

A NUMERIC METHOD FOR ESTIMATING INFILTRATION, REDISTRIBUTION, DRAINAGE, AND EVAPORATION OF WATER FROM SOIL,
Utah State Univ., Logan; Illinois Univ., Urbana; and Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02G.
W70-00862

A STUDY OF HOT WIRE AND HOT FILM ANEMOMETERS IN WATER (FRENCH),
Centre National de la Recherche Scientifique, Marseille (France); and Aix-Marseille Univ. (France). Institut de Mecanique des Fluides.
F. Resch, and M. Coantic.
English summary. La Houille Blanche, No 2, p 151-161, 1969. 17 fig, 21 ref.

Descriptors: *Instrumentation, *Turbulent flow, *Velocity, *Anemometers, *Flow measurement, Calibrations, Conduits, Engineering structures, Fluctuation, Cooling.
Identifiers: *Hot wire anemometer, *Hot-film anemometers, Circular conduits.

Methods of the measurement of mean and fluctuating components of velocity in turbulent flow of water using hot-film or hot-wire anemometers were investigated. A circulating water loop of circular flow cross-section and specially designed probes were built. New refinements of measuring and calibrating techniques were developed. This applied particularly to hot films of conical shape for which a dimensionless cooling law is proposed. Measurements of turbulence intensities and spectra along the axis of a circular conduit were obtained with an accuracy which compared favorably with that of measurement in dynamically similar air flows. (Carstea-USGS)
W70-00868

DETECTION OF CAVITATION BY ACOUSTIC AND VIBRATION-MEASUREMENT METHODS,
Technical Univ. of Budapest (Hungary). Dept. of Hydraulic Machinery.
For primary bibliographic entry see Field 08B.
W70-00875

THE RELATIONSHIP BETWEEN THE ULTIMATE RESISTIVITY OF CLAYEY SANDSTONES AND THEIR POROSITY AND CLAY CONTENTS (RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Geofizicheskikh Metodov Razvedki, Moscow (USSR).
D. A. Mel'nikov.
Prikladnaya Geofizika, No 3, p 149-159, 1968. 3 fig, 2 tab, 8 ref.

Descriptors: *Electrical resistance, *Sandstones, *Clays, *Porosity, *Resistivity, Electrical well logging, Petrology, Sedimentary rocks, Sands, Pores, Boreholes, Mathematical studies.
Identifiers: *USSR, Terek and Kuma River basins, Resistivity-porosity-clay relationship.

The resistivity-porosity-clay content relationship was analytically and experimentally studied using borehole data of sandstones of the Kuma and Terek River basins, USSR. The ultimate resistivity depends on both the porosity and clay content. Comparison of the mathematical equations with experimental data gave satisfactory results. (Gabriel-USGS)
W70-00876

ESTIMATION OF CLAY CONTENT OF SAND FORMATIONS FROM WELL-LOGGING DATA (RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Geofizicheskikh Metodov Razvedki, Moscow (USSR).
S. P. Kamenev.
Prikladnaya Geofizika, No 3, p 142-148, 1968. 2 fig, 5 ref.

Descriptors: *Clays, *Sands, *Sedimentary rocks, *Gamma rays, *Exploration, Porosity, Wells, Boreholes, Electrical well logging, Mathematical studies.
Identifiers: Gamma-ray logging.

The application of gamma-ray logging for the determination of clay content in sandy formations was investigated on the basis of analytical and experimental studies in gas- and oil-bearing formations at the depth of 1880-1890 m. The use of gamma-ray logging yields better interpretation of electrical well-logging data and, moreover, the gamma-ray method does not require the construction of standard curves for the determination of clay content. An equation is given for evaluating volumetric clay content. (Gabriel-USGS)
W70-00877

ON THE POSSIBILITY OF ESTIMATING THE THICKNESS OF UNCONSOLIDATED ROCKS BY VERTICAL ELECTRICAL SOUNDING IN PERMAFROST AREAS (RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Geofizicheskikh Metodov Razvedki, Moscow (USSR).
V. A. Kirillov, O. M. Kuvayev, L. M. Syuzyumov, and V. S. Yakupov.
Prikladnaya Geofizika, No 3, p 99-107, 1968. 2 fig, 1 tab, 5 ref.

Descriptors: *Sedimentary rocks, *Permafrost, *Electrical studies, *Exploration, Geophysics, Petrology, Seasonal, Electrical conductance, Density, River basins, Temperature, Surveys.
Identifiers: *Northeastern USSR, Electrical prospecting.

After a detailed critical analysis of the use of electrical prospecting methods in permafrost areas, a successful application of the vertical electrical methods for the determination of thickness of poorly-consolidated formations in the permafrost areas of the Berelekh, Delyankir, Khudzhakh, and Malyk-Siena River basins of northeastern Siberia is described. Some definite suggestions to improve the interpretation and the scope of application of the electrical prospecting method are also given. (Gabriel-USGS)
W70-00878

DIGITIZED PHYSICAL DATA OF A RANGELAND WATERSHED,
Agricultural Research Service, Boise, Idaho. Northwest Watershed Research Center; and Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 07C.
W70-00993

ON A SOIL AND GROUND WATER INVESTIGATION WITH THE SHALLOW REFRACTION METHOD AT MO I RANA,
Terratest A.B., Bromma (Sweden); and Swedish Geotechnical Inst., Stockholm.
B. Sjogren, and O. Wager.
Eng Geol, Vol 3, No 1, p 61-70, Jan 1969. 10 p, 7 fig, 6 ref.

Descriptors: *Seismic studies, *Geophysics, *Surveys, *Groundwater, Stratigraphy, Foundation investigations, Aquifers, Soil investigations, Water levels, Sands, Clays.
Identifiers: *Norway, Mo i Rana (Norway), Groundwater prospecting.

The shallow seismic refraction method--for more than 20 years well known as an useful tool for planning of dam sites, tunnels, roads and other construction works--has, during the last ten years also proved to be an excellent method to locate water-bearing fissured zones in bedrock, hidden by overburden. Furthermore, the method can be successfully applied to establish occurrence of different layers within the overburden. Seismic investigations at Mo i Rana, Norway, illustrate how a reliable picture of the subsurface conditions in an area with sand and clay deposits can be obtained with help of the fast seismic method. Also shown is the possibility of determining groundwater levels and directions of water flow. (Knapp-USGS)
W70-00995

AN INEXPENSIVE SHALLOW WATER TABLE PROBE,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
Fred Libby.
J Geol, Vol 77, No 5, p 626-628, Sept 1969. 3 p, 1 fig.

Descriptors: *Water levels, *Water table, *Groundwater, *Measurement, *Instrumentation, Sampling, Water measurement, Test procedures.
Identifiers: Groundwater level probe.

A method for rapidly determining shallow groundwater levels in sand and gravel profiles has been developed by the U.S. Department of Agriculture. By this method, an investigator can accurately determine depths to groundwater in a few minutes by direct measurement. The unit works in locations where the water table is almost 12 ft beneath the surface. The equipment required is simple, portable, and easily handled. It consists of a 13-ft-long, 3/8-inch-diam steel rod and driving ram. The steel rod has one-sixteenth of an inch holes drilled through it at 6-inch intervals. Couplings are of an electrical conduit type so that connections can be made without using wrenches. The rod is driven into the ground to its entire length with the driving ram and then extracted by hand. Upon extraction, the 6-inch-interval holes in the rod are examined to see which is the uppermost hole that contains water. This system for measuring shallow depths to the water table was used successfully on 2 consumptive-use surveys along the major length of the Santa Ynez River in California. (Knapp-USGS)
W70-00996

TIME VARIANT GROUND WATER FLOW BY RESISTANCE NETWORK ANALOGUES,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W70-01039

PHOTOGRAMMETRIC MEASUREMENT OF ROCK SURFACES IN A POWER TUNNEL,
Imperial Coll. of Science and Technology, London (England); Binnie and Partners, London (England); and Fairey Surveys Ltd. (Gr. Brit.).
D. E. Wright, D. E. Cox, and O. W. Cheffins.
Water Power, Vol 21, No 6, 7, p 230-234, 274-279, June-July 1969. 11 p, 14 fig, 3 tab, 9 ref, append.

Descriptors: *Profiles, *Photogrammetry, *Tunnels, *Surveying, *Stereoscopic, *Roughness (Hydraulic), *Tunnel hydraulics, Photographic equipment, Water tunnels (Conveyance), Photography, Surveying instruments, Underground structures, Stereoscopic map plotters, Roughness (Hydraulic), Roughness coefficient, Surfaces, Cross-sections.
Identifiers: Ground-based photogrammetry, Photographic analysis, Malaysia.

A photogrammetric method was used for measuring the shape of a 16-ft-dia hydroelectric power tunnel in Malaysia. Stereoscopic photographs were taken with a 4 x 5 Linhof Super Technika having a 150-mm lens; data were plotted using a Zeiss Stereoplanigraph C8. Professional photographic equipment can produce stereophotographs from which the position of the rock surface can be determined to an estimated accuracy of plus or minus 1/4 in. Over an area of 7 x 50 ft, control errors reduced the accuracy to plus or minus 1.3 in. Profiles can be plotted longitudinally or for cross sections. Details of the camera setup, surveying procedures, and plotting of data are given. (USBR)
W70-01090

EARTH RESOURCE SATELLITES,
Hawker Siddeley Dynamics Ltd., Hatfield (England).
G. K. C. Pardoe.
Sci J, Vol 5, No 6, p 58-67, June, 1969. 10 p, 10 fig, 5 ref.

Descriptors: *Aerial photography, Earth (Planet), Geology, Geography, Geologic investigations, Hydrology, Oceanography, Oceans, Maps, Land use, Surveys, Agriculture, Photographic equipment, Photographs, *Remote sensing, Resources, Resource development, *Natural resources, *Mapping, Sensors, *Reconnaissance surveys, Radar, *Satellites (Artificial).
Identifiers: Aerial reconnaissance, Airborne equipment, Airborne surveying, EROS (Acronym), Infrared photography.

Communications, meteorological, and navigation control satellites may have a large impact in private and public sectors and may make large profits for the nations owning them, but of all the direct-application sattellite systems envisioned, satellites for measuring the resources of the earth show the greatest promise of benefit to the world. The benefits will affect all mankind and will be manifest in terms of hard cash and in less direct ways that cannot be quantified in any detail. Study of these benefits shows that this will become a major application of satellite technology, and probably the greatest single direct use of space that can be foreseen. Advantages of satellite surveying include a continuous and regularly repeatable broad synoptic view of total earth cover over a long period, and low cost per unit of data collected. Sensors operating in different bands of the electromagnetic spectrum can measure a wide range of natural phenomena. Geologic, geographic, agricultural, and oceanographic applications are described. The equipment carried by satellites, handling of data, and administrative problems are discussed. Earth resource satellite programs in the U.S., the United Kingdom, and Europe are reviewed. (USBR)
W70-01098

MULTISENSOR ANALYSIS FOR SOILS MAPPING,
Bureau of Public Roads, Washington, D.C.; and Purdue Univ., Lafayette, Ind.
Harold T. Rib, and Robert D. Miles.
Highw Res Board, Spec Rep 102, p 22-37, 1969. 17 p, 6 fig, 1 plate, 2 tab, 5 ref.

Descriptors: *Soil classifications, *Soil engineering, Data reduction, Field data, Soil moisture, Aerial photography, *Radar, Data collections, Field classifications, Infrared rays, *Photography, Sensors, Ultraviolet rays, Analysis, *Remote sensing, Mapping.
Identifiers: *Soil maps, *Infrared photography, Photointerpretation, Test results, Infrared imagery, *Radar images, *Color photography.

A study project was instituted at Purdue University to investigate the potential of aerial films and sensors for detailed soils mapping. The first phase of the project was evaluating the potential of available types of aerial sensors and proposing a multisensor system for performing detailed engineering soils mapping. Results of the first phase study are described. During investigation of the various sensors, 9 flight coverages were made over 3 controlled test sites during a 13-mo period. Coverage was obtained using: (1) color positive, color infrared, color negative, black-and-white panchromatic, and black-and-white infrared aerial films; (2) a 9-lease multiband camera; (3) K-band radar sensors; (4) far infrared sensors, and (5) an ultraviolet through far infrared multichannel sensor. Not all combinations were used in any one flight program, but several combinations were used during each flight. The optimum system for delineating and mapping soils is a multichannel sensor flown simultaneously with an aerial mapping camera taking natural color photographs. Natural color was the most useful single film type. (USBR)
W70-01125

SURFACE AND SUBSURFACE EXPLORATION BY INFRARED SURVEYS,
Air Force Inst. of Tech., Wright-Patterson, AFB, Ohio; and Oklahoma State Univ., Stillwater.
R. V. Matalucci, and M. Abdel-Hady.
Highw Res Board, Spec Rep 102, p 1-12, 1969. 12 p, 13 fig, 19 ref.

Descriptors: *Aerial photography, Photography, *Infrared rays, Remote sensing, Sensors, *Infrared radiation, Instrumentation, Bibliographies, *Subsurface investigations, Pipelines, Planning, Locating, *Exploration, Mapping, Subsurface drainage, Geologic formations, Engineering geology, Reconnaissance surveys, Geologic mapping, Investigations.
Identifiers: *Infrared photography, Buried pipes, Photointerpretation, *Infrared detectors, Infrared imager, Infrared sensors, Infrared.

Basic principles relating to infrared radiation and demonstrating various applications of infrared photography and imagery to surface and subsurface exploration and terrain analysis for highway construction and other engineering projects are summarized. Infrared (IR) photography and imagery highlight variations in soil texture, composition, and moisture not usually recorded by conventional photography. The chlorophyll effect allows IR photography to assist in appraisal of cultivated land for right-of-way acquisitions. Hidden subsurface conditions and geological features of greatest importance during highway site selection and design, including muck pockets, underground cavities, volcanic and hydrothermal activities, subsurface drainage systems, and buried utilities and conduits can be exposed with IR instrumentation. Through further research in the techniques used for infrared remote sensing, surface and subsurface exploration and drainage studies for constructing highways, airports, and other projects may be greatly facilitated. (USBR)
W70-01128

STRENGTH TEST ON NEWLY FALLEN SNOW,
Forest Service (USDA), Salt Lake City, Utah. Alta Avalanche Study Center.
Ronald I. Perla.
USDA Forest Serv Res Note RM-150, 1969. 12 p.

Descriptors: *Snow, *Snow cover, *Snowpacks, *Measuring instruments, *Mechanical properties, On site tests, Shear stress, Strength, Physics.
Identifiers: Ram penetrometer, New snow, Drop cone penetrometer, Shear vane.

In situ strength tests previously applied to metamorphosed snow were modified to measure the mechanical properties of newly fallen snow during storms. A large drop cone penetrometer, protected from the wind by an aluminum shell, was used to determine snow 'hardness'. A lightweight model of the Haefeli ram penetrometer measured 'Ram Numbers.' Shear strengths were obtained from large, lightweight frames. Some preliminary tests were made with a shear vane driven by a torque wrench. A new technique was devised for measuring tensile strength: a cantilever beam of snow is undercut until it fails under its own weight.
W70-01221

FIELD EVALUATION OF SEEPAGE MEASUREMENT METHODS,
Idaho Univ., Moscow; and Agricultural Research Service, Kimberly, Idaho. Smake River Research Center.
For primary bibliographic entry see Field 04A.
W70-01236

REVIEW OF METHODS FOR MEASURING AND PREDICTING SEEPAGE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 04A.
W70-01238

7C. Evaluation, Processing and Publication

CATAD SYSTEM CONTROLS FOR REGULATION OF COMBINED SEWAGE FLOWS,
Municipality of Metropolitan Seattle, Wash.; and Metropolitan Engineers, Seattle, Wash.
For primary bibliographic entry see Field 05D.
W70-00889

RECORDS OF SELECTED WELLS AND SPRINGS IN THE RULISON PROJECT AREA, GARFIELD AND MESA COUNTIES, COLORADO,
Geological Survey, Denver, Colo.
Theodore R. Hurr, Woodrow W. Wilson, Frank A. Welder, and R. L. Emerson.
Geol Surv Open-file Rep, Sept 1969. 17 p, 1 fig, 1 plate, 3 tab, 3 ref. AEC Contract AT (29-2)-474.

Descriptors: *Data collections, *Hydrologic data, *Water wells, *Springs, *Colorado, Water levels, Water quality, Water yield.
Identifiers: Garfield County (Colo), Mesa County (Colo), Project Rulison, Well records.

An inventory of wells and springs in the Rulison project area and vicinity was made from March 20-April 3 and May 20-25, 1969, by the U S Geological Survey in cooperation with the U S Atomic Energy Commission. The project is an experimental study to determine the commercial feasibility of stimulating natural-gas production in the Rulison gas field by fracturing the resR. ERVOIR ROCITH A NUCLEAR EXPLOSION. The nuclear device will be implanted approximately 8,400 ft below land surface. The purpose of the study was to document the physical condition of wells and springs, and to collect samples of water prior to the nuclear event, for chemical analyses. During the field inventory, all wells and springs within a 10-km (6.2-mi) radius of the emplacement hole and selected wells and springs within the 10-km to 20-km (12.4-mi) radius were visited. Records of the inventoried wells and springs are given in tables, and their locations mapped. (Knapp-USGS)
W70-00987

GROUNDWATER IN SANTA BARBARA COUNTY, CALIFORNIA, SPRING 1967 TO SPRING 1968,
Geological Survey, Menlo Park, Calif.
R. E. Lewis.
Geol Surv Open-file Rep, May 1969. 30 p, 12 fig, 3 tab, 4 ref.

Descriptors: *Data collections, *Hydrologic data, *Groundwater, *California, Water levels, Water wells, Water utilization, Water quality, Water yield, Water storage, Water level fluctuations.
Identifiers: *Santa Barbara County (Calif).

Precipitation for the 1968 water year at Santa Barbara and Santa Maria was generally lower than the long-term average. Groundwater pumpage in the county was 307,000 acre-ft; this is an increase of 11,000 acre-ft over the amount estimated for the previous year but about equal to the annual average for the period 1963-67. Water levels were, on the average, slightly higher in most areas; as a result, estimates of change of groundwater in storage show a slight net increase over last year. In the Santa Maria Valley water level in one well in the southeastern part of the valley was about 86 ft higher, and groundwater in storage increased an estimated 176,000 acre-ft. Chemical analyses of water taken from wells during autumn 1967 show no significant change from analyses reported during the previous year, and there is no indication of intrusion of sea water in the coastal basins sampled. (Knapp-USGS)
W70-00989

DIGITIZED PHYSICAL DATA OF A RANGELAND WATERSHED,
Agricultural Research Service, Boise, Idaho. Northwest Watershed Research Center; and Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
G. R. Stephenson, and C. B. England.
J Hydrol, Vol 8, No 4, p 442-450, Aug 1969. 9 p, 6 fig, 11 ref.

Descriptors: *Data collections, *Data processing, *Digital computers, *Range management, Water conservation, Mapping, Surveys, Geologic mapping, Distribution patterns, Hydrogeology, Photogrammetry, Terrain analysis, Topography.
Identifiers: Boise (Idaho), Reynolds Creek Experimental Watershed.

Digitizing and photogrammetric equipment can facilitate hydrologic studies by sampling mapped information and by reducing it from graphical to numerical form. Such digitized data lend themselves to mathematical and statistical treatments by use of computers. In addition, digitized information can be processed by a X-Y plotter to obtain terrain profiles. Digitizing, recording, and plotting equipment has been used for interpreting various physical land features of the earth. By drawing on the relationships between soils and other land features, an index of total porosity, or of water-holding capacity, has been developed for grouping soil mapping units on a rangeland watershed. Such a method of combining soils by using an overall index that is hydrologically significant can reduce computational complexity and increase efficiency in design of hydrologic experiments, thereby reducing their costs. Procedures are described for sampling and digitizing physical data and the consistency of physical relationships are evaluated preliminary to more exacting analyses. Data were collected in the Reynolds Creek Experimental Watershed by the Northwest Watershed Research Center, Boise, Idaho. (Knapp-USGS)
W70-00993

LINEAR PROGRAMMING FOR HYDROLOGIC ANALYSES,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 02A.
W70-00999

COMPUTER PROGRAM FOR PLOTTING TIME DEPENDENT DATA WITH INSTRUCTION AND EXAMPLES,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
K. W. Brown, and Norman J. Rosenberg.
OWRR Project A-001-NEBR. Nebr Univ Coll Agr and Home Econ, Agr Exper Sta Rep MP23, July 1969. 35 p, 5 fig.

Descriptors: *Computer programs, *Digital computers, *Data processing, Hydrologic data, Publications, Documentation, Technical writing, Data storage and retrieval.
Identifiers: Computer data-plotting, Data presentation.

The use of multichannel automatic data recorders has necessitated the development of techniques for rapid analysis and presentation of data. A computer program was developed to plot time dependent data from a storage matrix. The body of the program, entitled TIMEPLOT, is written in FORTRAN IV. To minimize the run time required, the input and output subroutines are written in F level COBOL. Time, which may range from 1 hour to 16 days, is plotted on the abscissa. The program computes the intervals at which labels are placed and determines the required annotation. Data may be plotted as frequently as one observation per minute or as infrequently as one observation per day. The ordinate may represent any parameter. A single parameter may be plotted or several parameters may be superimposed upon each other. Combinations may be arranged on a single time axis. The program was designed with special features to facilitate the plotting of microclimatic, micrometeorological, and other types of time-dependent data. Plots drawn in india ink may be photographically reduced for use in reports and journal articles. Associated utility programs are also described. (Knapp-USGS)
W70-01008

ON THE PRESENT OPTIMUM VARIANT IN HYDROGEOLOGICAL EXPLORATION (GERMAN),
Central Geological Inst., Berlin (East Germany).
Hartmut Glander.
Zeitschrift fur Angewandte Geologie, Vol 14, No 9, p 459-465, Sept 1968. 4 fig, 13 ref.

Descriptors: *Hydrogeology, *Exploration, *Mapping, Groundwater, Aquifers, Petrography, Rivers, Transmissivity, Water chemistry, Discharge (Water), Carbonates, Nitrates.
Identifiers: *Berlin, Germany.

After stating the purpose and the preliminary postulates of hydrogeological exploration and mapping, the author gives a few examples of mapping hydrogeological elements in the area southeast of Berlin. Two maps of 1:50000 scale give the distribution of groundwater and transmissivity characteristics in the area. (Gabriel-USGS)
W70-01022

STOCHASTIC METHODS FOR ANALYZING RIVER BASIN SYSTEMS,
Cornell Univ., Ithaca, N.Y. Dept. of Water Resources Engineering.
For primary bibliographic entry see Field 06A.
W70-01085

INCREASES IN MAXIMUM STREAM TEMPERATURES AFTER SLASH BURNING IN A SMALL EXPERIMENTAL WATERSHED,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
Al Levno, and Jack Rothacher.
USDA Forest Serv Res Note PNW-110, Aug 69. 7 p, illus.

Descriptors: *Water temperature, *Temperature, *Clearcutting, *Water quality, *Burning, Heated water, Watershed management, Coniferous forests, Land management, Streamflow, Oregon.
Identifiers: Experimental watersheds.

The first year after slash was burned on a 237-acre clearcut watershed in the Cascade Range of Oregon, average maximum water temperatures increased 13 deg, 14 deg, and 12 deg F. during June, July, and August. A maximum stream temperature of 75 deg F. persisted for 3 hours on a day in July.
W70-01220

08. ENGINEERING WORKS

8A. Structures

ROLE OF PROGNOSIS OF GROUNDWATER STATE IN PROJECTION OF DAMS (POLISH),
Jan Flisowski.
English and Russian summaries. Przeglad Geol, Vol 17, No 7, p 347-352, 1969. 4 fig, 5 ref.

Descriptors: *Groundwater, *Reservoir leakage, *Dam design, *Water levels, Groundwater basins, Valleys, Rivers, Streamflow, Flooding, Water table, Water loss, Drainage systems, Engineering geology, Seepage, Water level fluctuations.
Identifiers: *Poland, Vistula River.

The effect of the projected Nowy Korczyn dam on the Vistula River, Poland, was investigated analyzing a river-drainage system-groundwater hydraulic scheme. The effect of groundwater ponding caused by dam construction on the development of a river valley depends not only on the height of river ponding, but also on the ponded water table in the near-dam reservoir. Water seepage can be determined on the basis of the preliminary forecasting studies of the immediate effect of river waters on groundwaters. If the near-dam reservoir is surrounded by side ramparts, the river valley is tranformed into a depression area subject to severe inundations. (Gabriel-USGS)
W70-00874

BRIDGES - BOUNDARY AND OTHER WATERS.
For primary bibliographic entry see Field 06E.
W70-00951

FINAL REPORT TO THE AMERICAN SOCIETY OF CIVIL ENGINEERS ON TASK 7 AND TASK 9 OF THE COMBINED SEWER SEPARATION PROJECT,
American Society of Civil Engineers, New York.
Robert N. Bowen, and John G. Havens.
Available from Clearinghouse as PB-185 992 at $3.00 in paper copy or $0.65 in microfiche. National Sanitation Foundation, ASCE Combined Sewer Separation Project, Dec 1967. 55 p, 18 fig, 4 tab, 14 ref. FWPCA Program No 11020 EKO.

Descriptors: *Construction materials, *Material testing, *On-site tests, *Pressure conduits, *Specifications.
Identifiers: *Cleaning procedures, *Conduit installation, *Fittings, *Plowing method, *Pressure sewer arrangements, *Sewer-within-sewer, *Special tools.

Assistance was provided in connection with special field trial installations of flexible tubing inserted in building sewers. Materials were proposed for pushing or pulling through a building sewer and a methodology and necessary attachments and tools were recommended. Polyethylene and polybutylene tubing are recommended for use inside building sewers and copper tubing for use in open trenches. A saddle type of connection is recommended for connection of pressure tubing to street pressure conduits. Cast iron, PVC, asbestos cement, or ductile iron are recommended for pressure conduits. Experience with plowing of pressure pipe is reviewed. Reference is made to standard practice for trench installations, street crossings and thrust blocking. Two methods of cleaning hose pressure tubing are proposed. Six possible layouts of pressure conduits are discussed in terms of operation and maintenance. All six arrangements provide for routine rerouting of flow by exploiting a dual conduit configuration. (Tucher-ASCE)
W70-01043

DEVELOP AND FIELD TEST METHOD OF INSTALLING PRESSURE CONDUITS IN COMBINED SEWERS,
American Society of Civil Engineers, New York.
Henry J. Kazienko.
Available from Clearinghouse as PB-186 005 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Johns-Manville R and D Center, Dec 30, 1968. 38 p, 15 fig, 9 tab. FWPCA Program No 11020 EKO.

Descriptors: *Design, *On-site-tests, Epoxy resins, Pressure conduit.
Identifiers: *Development, *Polyester conduit hanger, Allowable load, Combined sewer.

This report describes laboratory development and testing of polyester molded hangers cemented to a sewer pipe crown. Polyester hanger material formulations, epoxy cement, and hanger dimensions are specified, and methods of installation given in detail. Test of the hanger to failure in the laboratory showed fracture in tension through the conduit ring, leaving the upper part bonded to the concrete sewer crown. The field installation of 100-ft. of 3-in. diameter PVC pipe filled with water was made in a 7-ft. sewer in Evanston, Ill., in cooperation with the Metropolitan Sanitary District of Greater Chicago. The installation was sound and unaffected when removed after 4 1/2 months. (Tucker-ASCE)
W70-01044

REPORT ON PRESSURE SEWERAGE SYSTEM, SUMMER STREET SEPARATION STUDY AREA, BOSTON, MASSACHUSETTS,
American Society of Civil Engineers, New York; and Camp, Dresser and McKee, Boston, Mass.

Available from Clearinghouse as PB-186 000 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Report Sept 1968. 82 p, 24 fig, 16 tab, 10 ref. FWPCA Program No 11020 EKO.

Descriptors: *Cost analysis, *Design, Pressure conduit.
Identifiers: *Building plumbing separation, *Sewer separation, Boston (Mass), Gravity sewer, Sewage flow variations.

The report is one of three by consultants to study the design, estimate costs and evaluate the feasibility of the hypothetical application of the ASCE Project Scheme of pressure sewers for separation in representative combined sewer areas from layouts by the Project Staff. The Boston study considered the 53-acre gently sloping, heterogeneous commercial Summer Street Separation Study Area, including many buildings built in the late 1800's. The report describes the separation of building plumbing in detail in a typical three-quarter century old five story and basement commercial building 65-ft. by 145-ft. in plan, and estimates the cost of plumbing separation. Four alternative pressure sewer collection systems are indicated with plans and hydraulic profiles. Some systems included in-line main pumping stations. The least expensive complete pressure system, which did not include a main pumping station, is estimated to cost $6,400,000 compared to the cost of a gravity separation system designed by the consultants, estimated to cost $4,700,000. Both costs include costs of building plumbing separation, $4,000,000 for the pressure system including communitors, wet walls and non-clog pumps, and $2,000,000 for the gravity systems. (Tucker-ASCE)
W70-01051

COMBINED SEWER SEPARATION PROJECT, REPORT ON MILLWAUKEE STUDY AREA.
American Society of Civil Engineers, New York; Greeley and Hansen, Chicago, Ill.

Available from Clearinghouse as PB-186 003 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project Report, Dec 1968. 84 p, 12 fig, 10 tab, 11 ref. FWPCA Program No 11010 EKO.

Descriptors: *Annual costs, *Cost analyses, Design, Pressure conduit.
Identifiers: Building plumbing separation, Sewer separation, Gravity sewer, Milwaukee (Wis), Sewage flow variations, Storage-grinder-pump.

The report is one of three by consultants to study the design, estimate costs and evaluate the feasibility of the hypothetical application of the ASCE Project scheme of pressure sewers for separation in representative combined sewer areas from layouts by the Project staff. The Milwaukee study considered the 157-acre mainly dense residential, moderately sloping Prospect Avenue Study Area essentially built prior to 1930 with many buildings dating from before 1900. The report describes methods of building plumbing separation and indicates two alternative arrangements of pressure sewers with plans and a profile. Estimates of construction cost of each ($3,225,000 and $3,260,000) are compared with that of a conventional gravity system of separation designed by the consultant ($2,195,000). Plumbing separation, included in the above, is estimated to cost $912,000 for the gravity alternative and $971,000 for the pressure alternatives, not including storage-grinder-pump units. (Tucker-ASCE)
W70-01052

SEPARATION OF COMBINED WASTEWATER AND STORM DRAINAGE SYSTEMS, SAN FRANCISCO STUDY AREA.
Brown and Caldwell, San Francisco, Calif.

Available from Clearinghouse as PB-186 001 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project Report, Sept 1968. 81 p, 23 fig, 11 tab, 13 ref. FWPCA Program No 11020 EKO.

Descriptors: *Cost analysis, *Design, Pressure conduit.
Identifiers: *Building plumbing separation, *Sewer separation, Gravity sewer, Plumbing code, San Francisco (Calif), Storage-grinder pump.

The report is one of three by consultants to study the design, estimate costs and evaluate the feasibility of the hypothetical application of the ASCE Project Scheme of pressure sewers for separation in representative combined sewer areas from layouts by the Project staff. The San Francisco study considered the 323 acre predominantly residential, steeply sloping Laguna Street Sewer Service District, rebuilt since the 1906 fire. The report describes methods of building plumbing separation and indicates two alternative arrangements of pressure sewers, with plans and profiles. Estimates of construction cost of each ($13,000,000 and $13,350,000) are compared with that of a conventional gravity system of separation designed earlier by the City ($8,800,000). Plumbing separation, included in the above, is estimated to cost about $5,400,000 for the gravity method and about $4,400,000 for the pressure method not including storage-grinder-pump units. (Tucker-ASCE)
W70-01053

OUTLINE DESCRIPTION OF ASCE PROJECT ON 'SEPARATION OF SANITARY SEWAGE FROM COMBINED SYSTEMS OF SEWERAGE'.
American Society of Civil Engineers, New York.

Available from Clearinghouse as PB-185 995 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 1, Feb 21, 1966. 9 p, 2 fig, 1 ref. FWPCA Program No 11020 EKO.

Descriptors: *Pressure conduits.
Identifiers: *Combined sewers, Comminuted sewage, Sewer separation.

Descriptions of the project separation scheme, project goal and project background are given. The general concept of the ASCE Project scheme is to pump comminuted sanitary sewage from individual buildings and building complexes through relatively small pressure tubing laid in existing building connections and thence into new pressure conduits suspended in existing street sewers. Potential advantages of the scheme are discussed. The ultimate goal of the Project is to develop feasible designs and operations and to put them to test in actual systems. The immediate objective is to examine and evaluate both the feasibility and probable cost. The background of the project is reviewed. Dr. Gordon M. Fair conceived the scheme on which the Project is based. An appendix summarizes the need for separation of combined sewerage systems and the national scope of the problem. (Tucker-ASCE)
W70-01054

STUDY OF APPROXIMATE LENGTHS AND SIZES OF COMBINED SEWERS IN MAJOR METROPOLITAN CENTERS,
American Society of Civil Engineers, New York.
Dasel E. Hallmark, and John G. Hendrickson.
Available from Clearinghouse as PB-185 999 at $3.00 in paper copy and $0.65 in microfilm. ASCE Combined Sewer Separation Project, Technical Memorandum No 4, May 1, 1967. 9 p, 2 tab. FWPCA Program No 11020 EKO.

Descriptors: *Sewers.
Identifiers: *Combined sewers, *Sewer sizes, *Combined sewer lengths, Walk-through sewers.

A tabulation is given for five major cities of mileage and percentage of combined sewers with heights: greater than 48 inches; equal to or less than 48 inches; and equal to or less than 24 inches. An average of 72 percent of the sewers are smaller than 24 inches. Heights of 54 inches and larger, classified as walk-through sewers, account for an average of about 15 percent of the total combined sewer mileage. (Tucker-ASCE)
W70-01057

PRESSURE TUBING FIELD INVESTIGATION,
American Society of Civil Engineers, New York.
L. Scott Tucker.
Available from Clearinghouse as PB-186 011 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 5, Aug 15, 1967. 29 p, 19 fig, 2 tab, 1 ref. FWPCA Program No 11020 EKO.

Descriptors: *On-site tests, Conduits, Cost analysis, Trenches.
Identifiers: *Sewer-within-sewer, Building lateral, Copper tubing, Plastic tubing, Pressure sewers, Washington, D.C.

Three methods of installing pressure tubing from houses or small buildings, and of connecting the tubing with street pressure conduits, are described and discussed. One would be the installation and connection of pressure tubing and conduit in trenches by traditional water distribution methods. Field trials were conducted to indicate the feasibility of inserting tubing in building sewers. Tubing was pushed through an 86-foot long 4- 5-inch diameter building lateral, which included three 45 deg bends, from a specially dug pit at the upstream end into a 4-foot diameter combined sewer. The forward end of the tubing was guided by a special leader device. Three fourths-, 1-, and 1 1/2-inch polyethylene tubing could be pushed. Polybutylene and copper tubes could not be pushed because they buckled or crimped. A Kellems grip and swivel on the end of a rope were used to pull tubing from the combined sewer to the upstream pit. Three fourths-, 1-, and 1 1/4-inch polyethylene and 3/4- and 1-inch polybutylene could be pulled. Three fourths-inch copper tubing could not be pulled because of its stiffness. The third method, tested in the field, combined the insertion of tubing with a street main in trench. Cost estimates were made for the later two methods. (Tucker-ASCE)
W70-01058

NON-MECHANICAL CONSIDERATIONS INVOLVED IN IMPLEMENTING PRESSURIZED SEWERAGE SYSTEMS,
American Society of Civil Engineers, New York.
Donald H. Waller.
Available from Clearinghouse as PB-186 008 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 12, May 31, 1968. 27 p, 1 tab, 4 ref. FWPCA Program No 11020 EKO.

Descriptors: *Administration, *Economic justification, *Legal aspects.
Identifiers: *Interviews, Radcliff (Ky), Storage-grinder-pump.

Installation of a storage-grinder-pump unit in every home raises questions regarding: allocation of costs of the units; responsibility for malfunction of the units; arrangments for service of the units; and willingness of owners to accept the presence of units in their buildings. Twenty-five householders in Radcliff, Kentucky, whose houses are served by sewage ejector units were interviewed to obtain opinions about features of the units that appeared to represent potential sources of nuisance, inconvenience, or other liabilities. Also interviewed were the superintendent of the utility operating the Radcliff sewerage system, owners of five houses in Louisville, Kentucky, at which sewage sampling stations were located, and three consulting engineering firms who have considered schemes involving the installation of sewage pumping equipment on private properties. Opinions and practices reported reflect the view that sewage pumping equipment placed on private property as part of a public project should be purchased, installed, and serviced at public expense. (Tucker-ASCE)
W70-01065

SPECIAL REQUIREMENTS FOR A FULL SCALE FIELD DEMONSTRATION OF THE ASCE COMBINED SEWER SEPARATION PROJECT SCHEME,
American Society of Civil Engineers, New York.
Donald H. Waller.

Available from Clearinghouse as PB-186 009 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 13, June 3, 1968. 84 p, 12 fig, 13 tab, 10 ref. FWPCA Program No 11020 EKO.

Descriptors: *Benefits, *Costs, Anaerobic conditions, Legal aspects, Measurement, Overflow.
Identifiers: *Field demonstration planning, Flow obstructions, Interviews, Public cooperation, Sewer separation, Storage-grinder-pump.

Matters that should be considered in planning a field demonstration of the ASCE Project pressure sewer scheme are summarized. These include: importance of connecting as many buildings as possible in the demonstration project area; need for protection from overflows of building storage-grinder-pump units; relationship between occurrence of overflows from buildings and given levels of public inspection, detection and control; effectiveness of alarms on storage-grinder-pump units; legal agreements with property owners; importance of complete records of project costs; effectiveness of the project as a pollution control measure; possible benefits of elimination of infiltration from interceptors and treatment plants; detection and clearing of obstructions; use of polymer additives to reduce fluid friction; behavior of unground sewage including anaerobic decomposition; self-cleansing characteristics of flow; rate and extent of deterioration of friction factors; sewage flow variations and their relationship to water demands; handling of interruptions of service; and field tests on installations in walk-through combined sewers. The appendix is an assessment of the physical problems to be overcome in separation of plumbing on private property, with estimates of cost, based on information from officials in seven large cities having combined sewers, and from a consulting engineer and a recent American Public Works Association survey. (Tucker-ASCE)
W70-01066

ROUTING OF FLOWS IN SANITARY SEWERAGE SYSTEMS,
American Society of Civil Engineers, New York.
L. Scott Tucker.
Available from Clearinghouse as PB-186 010 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 14, July 18, 1969. 39 p, 15 fig, 1 tab, 8 ref. FWPCA Program No 11020 EKO.

Descriptors: *Attenuation, Hydrographs, Pressure conduits, Water demand.
Identifiers: *Flow routing, *Theoretical moments, Dwelling units, Mean Milwaukee (Wis), Nodes, Peak flow, Skewness, Variance.

Water demand data from individual homes, assumed to represent sewage flows, were combined by routing into a 10-home input unit. These input units were then routed through a hypothetical pressure sewer collection system via a hydrograph superposition procedure. The hypothetical pressure sewer system served 3,270 dwelling units. The ratio of peak flow to the two-week average flow was 2.7 at the outlet. Similar analyses of portions of the pressure system consisting of 1,000 and 250 dwelling units were made. The ratio of peak to the two-week average for the 1,000 dwelling unit portion of system was 3.5, and for the 250 dwelling unit portion of the system was 4.0. A method of analysis based on notes and calculations of Professor H. A. Thomas of Harvard U. involving theoretical moments of frequency distributions is presented. The method is explained by applying it to a simple example of a sewage collection system. The method provides an estimate of peak flows and time of occurrence, and has a potential for examining parameter sensitivity. (Tucker-ASCE)
W70-01067

A WATER DISTRIBUTION SYSTEM FOR COLD REGIONS, The Single Main Recirculating Method. An Historical Review, Field Evaluation, and Suggested Design procedures,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 04A.
W70-01088

THE SEISMIC DESIGN STUDY OF A DOUBLE CURVATURE ARCH DAM,
Gibb (Alexander) and Partners, London (England); Imperial Coll. of Science and Technology, London (England); and Bristol Univ. (England).
P. A. A. Back, A. C. Cassell, and R. Dungar.
Inst Civ Eng Proc, Vol 43, p 217-248, June, 1969. 32 p, 19 fig, 3 tab, 17 ref, 3 append.

Descriptors: *Seismic design, Seismic studies, *Arch dams, Vibrations, *Model tests, Earthquakes, Earthquake engineering, Foreign research, Stress, Digital computers, Test procedures, Analysis, Natural frequency, Electric analogs, Mathematical analysis, Computer programming, Bibliographies.
Identifiers: *Seismic tests, *Double-curvature arch dams, Earthquake loads, Great Britain, Republic of So Africa, Test results, Dynamic tests.

Use of high-speed digital computers in the application of a new technique of earthquake design to study seismic behavior of an arch dam is described. This study applies to the Hendrik Verwoerd Dam on the Orange River, Republic of South Africa. The technique (based on use of finite elements) takes full account of dynamic response of a structure to an earthquake, providing a complete history of stresses and deflections within the arch during the passage of the earthquake. To avoid an enormous printout of noncritical information, provision is made to print only the maximum envelope of principal stresses and deflections and times of occurrences. A printout can be provided of the instantaneous state of stress and deflection of the structure for any given moment which, from examination of the times of the occurrence of the maxima, is particularly significant. Scale model tests of the dam are described whereby critical frequencies of vibration, predicted by mathematical analysis, were subsequently verified by a method of multipoint vibration resonance tests. Results of tests using these new techniques are compared with the classical method of earthquake analysis, indicating dynamic stresses in certain parts of the dam were underestimated by factors of 2 or 3. (USBR)
W70-01094

DESIGN OF CALIFORNIA AQUEDUCT,
California State Dept. of Water Resources, Sacramento.
Harald D. Frederiksen.
Proc Amer Soc Civ Eng, J Irrig Drain Div, Vol 95, No IR2, p 307-328, June, 1969. 22 p, 8 fig, 3 ref, 2 append.

Descriptors: *Aqueducts, *California, Design, Design criteria, Canals, Water resources development, Pipelines, Channels, Reservoirs, Planning, Pumping plants, Operation and maintenance, Remote control, Distribution systems, Monitoring, Simulation, Irrigation, Operations, Water delivery, Water management (Applied), Computer programming.
Identifiers: *California Aqueduct, California Department of Water Res, San Joaquin Valley (Calif), Systems engineering, Emergency closures.

The design of the California Aqueduct Project by the California Department of Water Resources considered the scheme of operation as an integral component of the physical design of the system. The scheme was based on an analysis of existing water delivery projects, definition of project functions, and extensive analysis, including computer simulation. Developing a controlled volume concept of operation and design for remote control made possible greater reliability, more efficient operation, and rapid response in emergencies. The result is an aqueduct designed and constructed to reliably, efficiently, and economically deliver water to the San Joaquin Valley and Southern California. A greater degree of safety and reliability is provided than was possible by traditional design and operation methods. (USBR)
W70-01111

THE ASWAN HIGH DAM,
Texas Univ., Austin.
For primary bibliographic entry see Field 06B.
W70-01201

NEW WATER BIRD FOR EGYPT: A ROBOT SHADOOF,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 03F.
W70-01205

8B. Hydraulics

ANALYTICAL SOLUTION FOR TURBULENT FLOW IN PIPES,
Universidad Central de Venezuela, Caracas. Dept. of Engineering.
A. Zagustin, and K. Zagustin.
La Houille Blanche, No 2, p 113-118, 1969. 3 fig, 1 append.

Descriptors: *Turbulent flow, *Pipes, *Pipe flow, Velocity, Mixing, Eddies, Viscosity, Theoretical analysis, Equations, Energy equation.
Identifiers: *Circular pipe, Differential equations, Pulsation energy.

New analytical expressions are given for the velocity, mixing length and eddy viscosity for turbulent flow in a smooth circular pipe. These expressions are obtained from a set of differential equations for turbulent flow plus a 'balance of pulsation energy' equation. The present theoretical results agree better with the experimental data than those of earlier theories, and furthermore, in contrast to earlier theories, the velocity distribution curve has no singularity at the center line. (Carstea-USGS)
W70-00870

NON-LINEAR FREE SURFACES IN OPEN CHANNELS (FRENCH),
Centre National de la Recherche Scientifique, Chatillon-sous-Bagneux (France). Centre de Calcul Analogique.
C. Bellevaux, and D. Fruman.
La Houille Blanche, No 2, p 119-122, 1969. 7 fig, 7 ref.

Descriptors: *Open channels, *Free surfaces, *Open channel flow, *Flow, *Supercritical flow, Subcritical flow, Measurement, Equilibrium, Stability.
Identifiers: Non-linear free surfaces, Sills.

A calculation method is presented for free flow surfaces with sills. Use of transformed plan enables the free surface position to be established. The non-linear surface equilibrium condition is met by successive approximation. Two calculation schemes are presented, one for supercritical flow and the other for subcritical flow. A stability study shows only the former scheme to be stable; the subcritical scheme will not converge unless modified. The scope of the method is illustrated by examples. (Carstea-USGS)
W70-00871

PROPAGATION OF WAVE-FRONTS IN WIDE CHANNELS OF ARBITRARY CROSS-SECTION,
Leeds Univ. (England).
G. D. Crapper.
La Houille Blanche, No 2, p 123-126, 1969. 6 fig, 3 ref.

Descriptors: *Waves (Water), *Channels, *Open channel flow, *Unsteady flow, Cross-sections, Hydraulics, Channel flow, Equations, Mathematical studies.
Identifiers: *Wave-front propagation, Triangular-section open channels.

A simple method for predicting the movement of a wave-front and a measure of its strength in a system described by hyperbolic partial differential equations is adapted from published work and applied to channel hydraulics. The equations are applicable to any channel configuration including longitudinal and transversal channel variations. A solution for a channel with a triangular cross-section is discussed. The wave-fron splits along the centerline and the initial disturbance moves away to the sides of the channel. (Carstea-USGS)
W70-00872

EXPERIMENTAL RESEARCH ON SPILLWAY SHAFT FLOW (FRENCH),
Liege Univ. (Belgium).
A. Schlag.
La Houille Blanche, No 2, p 127-136, 1969. 23 fig, 1 tab.

Descriptors: *Closed conduit flow, *Shafts (Excavation), *Spillways, *Research and development, Discharge (Water), Pressure head, Froude number, Weirs, Pipe flow, Pipes, Mathematical studies, Orifice flow.
Identifiers: Weir flow, Pressure pipe flow.

The relationships between vertical-shaft spillway discharge, head at the shaft and diameter and length of the column are studied. The relationship between the non-dimensional factors of head/diameter, length/diameter, and Froude number is also establshed. Depending on the Froude number, the following cases of flow are possible: (1) weir flow giving a parabolic curve with a horizontal axis; (2) pressure pipe flow giving a parabola with a vertical axis; (3) orifice flow under certain discharge conditions and for Froude number of about 0.5. A different type of orifice flow is produced by a momentary outside influence. Formulae are presented and discussed for 3 forms of flow. (Carstea-USGS)
W70-00873

DETECTION OF CAVITATION BY ACOUSTIC AND VIBRATION-MEASUREMENT METHODS,
Technical Univ. of Budapest (Hungary). Dept. of Hydraulic Machinery.
J. J. Varga, G. Sebestyen, and A. Fay.
La Houille Blanche, No 2, p 137-149, 1969. 26 fig, 24 ref.

Descriptors: *Cavitation, *Vibrations, *Acoustics, Pumps, Turbines, Tunnels, Flow, Velocity, Erosion.
Identifiers: *Cavitation detection, Noise measurement, Cavitation erosion.

The validity of acoustic methods for incipient cavitation determination is confirmed by measurements of noise from pumps and Francis turbines in a cavitation tunnel. Cavitational flow shows two noise-generating sources: (1) the noise produced by flow conditions, emitted at a discrete frequency; (2) the noise produced by the collapse of the cavitation bubbles, which covers a wide frequency band. Acceleration level measurements seem to be much more advantageous than the sound pressure level measurements. The intensity of cavitation erosion is highly correlated with the intensity of the noise. Noise intensity is proportional to the fifth power of velocity under cavitation conditions. (Carstea-USGS)
W70-00875

ANALYTICAL STUDIES OF TURBULENT FRICTION IN ANNULAR CONDUITS,
American Society of Civil Engineers, New York.
Alan R. Nelson, and James M. Robertson.
Available from Clearinghouse as PB-186 002 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, University of Illinois, T and AM Report No 321, Nov 1968. 81 p, 38 fig, 5 tab, 16 ref. FWPCA Program No 11020 EKO.

Descriptors: *Flow rates, *Pressure conduits, *Roughness, Digital computer, Head loss, Turbulent flow.
Identifiers: *Annular pipes, *Eccentricity, *Radius ratio, *Velocity distribution, Diessler and Taylor, Sewer-within-sewer.

An analytical solution for fully developed turbulent flow in an annular conduit is presented, performed with the aid of a digital computer. To account for the observed divergence of the velocity traverses of recent investigations with increasing ratio of radius of inside wall of outside pipe to radius of outside of inserted pipe, a modified wall law-core law velocity formulation is adopted. The effect of variations in radius ratio, eccentricity, and roughness upon the location of maximum velocity, velocity distribution, and friction are discussed. The radius of maximum velocity is found to be nearer the wall of the inserted pipe for smooth annuli and is independent of Reynolds number for values greater than 40,000. Friction decreases with increased eccentricity but is considerably less affected by changes in the radius ratio. Variations in wall roughness cause the greatest alteration in the flow occurrences in annular conduits. Using the modified two-law velocity distribution, a new prediction of friction is given for the limiting case of radius ratio approaching unity. Even though equivalent magnitudes were not achieved for experimental and analytical results, the trends are similar. (Tucker-ASCE)
W70-01045

TURBULENT FRICTION IN ECCENTRIC ANNULAR CONDUITS,
American Society of Civil Engineers, New York.
James M. Robertson.
Available from Clearinghouse as PB-185 993 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Univ of Illinois, T and AM Report No 310, Mar 1968. 63 p, 13 fig, 3 tab, 48 ref. FWPCA Program No 11020 EKO.

Descriptors: *Flow around objects, *Head loss, *Pressure conduits, Data collections, Flow rates.
Identifiers: *Annular pipes, *Hangers, Eccentricity, Sewer-within-sewer.

Following a general review of the analytical and experimental information on the friction loss encountered by fluids flowing in annular pipes, with particular regard to the influence of eccentricity of the inner member, experiments are described on an evaluation of the friction of water in a steel annular pipe of diameter ratios 5.8 and 3.2 in the Reynolds number range of ten to the fifth power to ten to the sixth power. It is found that on a discharge basis, for the same head loss in a given length, with the diameter ratio of 5.8 the flow capacity of the pipe line is decreased 12.7% in the concentric situation but only 4.5% with full eccentricity. The latter decrease is not greatly different from the 3% reduction in area due to the inserted smaller pipe. An analysis is included showing that for the simple insert at full eccentricity the near-full-flow capacity of a sewer is little affected. The effects of hangers such as might be employed to support inserts in sewers is found to have an appreciable effect on the flow capacity of a full-flowing sewer. (Tucker-ASCE)
W70-01046

RELATIONSHIP OF SEWAGE CHARACTERISTICS TO CARRYING VELOCITY FOR PRESSURE SEWERS,
American Society of Civil Engineers, New York.
M. Floyd Hobbs.
Available from Clearinghouse as PB-185 991 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, FMC Corporation Report No R-2598, Aug 1967. 96 p, 10 fig, 54 tab, 2 ref. FWPCA program No 11020 EKO.

Descriptors: *Data collections, *Deposition (Sewage sediments), *Pressure conduit, *Scour.
Identifiers: *Sand concentration, *Sewage analysis, Comminutor, Grinder, Santa Clara (Calif).

Minimum carrying velocities for solid phase matter in smooth plastic 2 in., 3 in., 4 in., 6 in., and 8 in. pressure pipes were measured using comminuted and uncomminuted raw sewage. The minimum velocity for scouring and the maximum velocity for depositing were essentially the same. Velocities appeared to be independent of: the concentration magnitudes of suspended solids, fixed suspended solids, sand concentration, and the size distribution of suspended matter and sand for the sewages studied. Velocities appeared to be dependent on the fixed solids content or sand which accumulated on the pipe bottom. Egg shells that had been passed through a garbage grinder were carried at lower flow rates than required for moving the bottom sediments. Carrying velocities were investigated in an 8 in. spiral pressure pipe but the results obtained were very erratic. Tests were also made on the 8 in. plain plastic pipe with open channel flow. All data acquired are reported. (Tucker-ASCE)
W70-01047

LONG-TERM OPERATION OF WASTEWATER OBSERVATION STATIONS (TASK 2),
American Society of Civil Engineers, New York.
R. Paul Farrell.
Available from Clearinghouse as PB-185 994 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, General Electric Co Report No S-68-1064, Apr 24, 1968. 48 p 12 fig, 13 tab, 5 ref. FWPCA Program No 11020 EKO.

Descriptors: *Maintenance, *Pressure conduit, Data collections, Laboratory tests.
Identifiers: *Operating experience, *Wastewater sampling stations, check valve operation, On-site observations, Plumbing fixture tests, Pump operation, Sewage flow (Household).

In the terminal phase of operation of two household wastewater observation stations, the stations were operated for seven months during which the principal objective was collection of usage experience. The two garbage grinders were never a source of difficulty. The 3/4-inch check valves regularly trapped fibrous or stringy materials. A significant increase in head loss in the 3/4-inch discharge tubing in the last month of operation at one station is attributed to a thick coating of anaerobic slime on the interior walls, attributed to low inflow rates and extended periods of disuse. The 1-inch tubing at the other station was essentially clean throughout the tests. Results of fixture flow tests, and information on overflows from the station wet-wells, was obtained to supplement results of the earlier studies. (Tucker-ASCE)
W70-01049

SAMPLING AND ANALYSIS OF WASTE WATER FROM INDIVIDUAL HOMES (TASK 2),
American Society of Civil Engineers, New York.
R. P. Farrell, J. S. Anderson, and J. L. Setser.
Available from Clearinghouse as PB-185 990 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, General Electric Co Report No 67-MAL-3, Mar 24, 1967. 79 p, 16 fig, 17 tab, 8 ref. FWPCA Program No 11020 EKO.

Descriptors: *Data collections, *Laboratory tests, *Water demand (Household), Hydrographs, Peak discharge, Telemetry.
Identifiers: *Sewage flow (Household), *Wastewater sampling stations, Domestic wastes grinder, Louisville (Ky), Plumbing fixture tests.

The results of the initial phase of operation of two household wastewater observation stations are described. During a three month period household wastewater was sampled for analysis, wastewater flow rates were measured, and the behavior of components when handling wastewater under actual conditions of use was observed. Each station included a garbage grinder for reduction of incoming sewage solids sizes, a float well and level recorder, a pump and pump operation time

recorder, a check valve on the pump discharge line, and fifty feet of clear plastic discharge tubing. An extensive program of sampling and analysis was carried out to characterize completely the wastewater from each home. Particulate matter in the wastewater was analyzed over an intensive seven-day period to determine its exact nature in terms of particle size, density and microscopic appearance. Analyses were made of water demand data obtained from measurements at one gallon intervals at each house telemetered to recording equipment. A set of fixture tests, during which fixtures were discharged singly and in combinations in preplanned sequences, was run at both stations to obtain information on water and sewage flow patterns for fixtures. (Tucker-ASCE)
W70-01050

SEWAGE FLOW VARIATIONS IN INDIVIDUAL HOMES,
American Society of Civil Engineers, New York.
L. Scott Tucker.
Available from Clearinghouse as PB-185 996 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 2, Feb 24, 1967. 70 p, 7 fig, 25 tab, 2 ref. FWPCA Program No 11020 EKO.

Descriptors: *Water demand (Household), *Data collections, Pumping, Storage, Design, Pipe, Distribution patterns.
Identifiers: *Peak demands, *Sewage flow (Household), Flow routing.

Winter water demands are assumed to represent sewage flows in the absence of sewage flow data. Two sets of 1-minute interval household water demand data are used: from six homes in Maryland for two weeks, and from two homes in Louisville for four weeks. Maximum and minimum 24-hour and 60-, 15-, and 4-minute demands for each day are given for each home. Frequency distributions of 24-hour and 60-minute flows for each sample are compared with each other and with distributions of total flows from groups of 3 houses and 6 houses. Based on routing of peak flows from nearly five hundred home-days of data through various storage-pump combinations, a pump capacity of 10 GPM and a usable storage capacity of 30 gal. are indicated for initial sizing of household storage-grinder-pump units. Pressure discharge tubing to handle expected flows at reasonable head losses would be 3/4 to 1 1/4 inch I.D. (Tucker-ASCE)
W70-01055

MINIMUM TRANSPORT VELOCITY FOR PRESSURIZED SANITARY SEWERS,
American Society of Civil Engineers, New York.
Murray B. McPherson, L. Scott Tucker, and M. Floyd Hobbs.
Available from Clearinghouse as PB-186 013 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 7, Nov 16, 1967. 23 p, 4 fig, 2 tab, 8 ref. FWPCA Program No 11020 EKO.

Descriptors: *Deposition (Sewage sediments), *Pressure conduits, *Scour, Data collections, Design criteria, Regression analysis.
Identifiers: *Sand concentration, *Sewage analysis, *Transport velocity, Comminution, Grinding, Sanitary sewage.

Raw sewage, with and without particle-size reduction by comminution, was pumped through 2-in. to 8-in. clear plastic pipe. Extensive observation indicated rather conclusively that the material last to be scoured and first to be deposited was predominantly sand. For all tests, the sewage was salted with ground egg shells but these were always moved at lower mean flow velocities than the sand, which was in low concentrations, viz., 8 to 78 ppm. No discernable difference was noted in the minimum transport velocities for comminuted and uncomminuted sewage, and the difference between minimum scouring velocities and maximum depositing velocities was small. Test results were blended with those from sand transport experiments elsewhere for general representation. Exploratory open channel tests were made with the 8-in. pipe for a firmer correlation with sand tests. Results are presented in terms of dimensionless parameters. Limited tests were made on 8-in. spiral corrugated pipe. (Tucker-ASCE)
W70-01060

DOMESTIC SEWAGE FLOW CRITERIA FOR EVALUATION OF PROJECT SCHEME TO ACTUAL COMBINED SEWER DRAINAGE AREAS,
American Society of Civil Engineers, New York.
Murray B. McPherson.
Available from Clearinghouse as PB-186 014 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 8, Nov 17, 1967. 19 p, 2 fig, 3 tab, 9 ref. FWPCA Program No 11020 EKO.

Descriptors: *Design criteria, *Water demand (Residential), Data collections.
Identifiers: *Domestic water use, *Peak demands, Demand variations, Sewage flow.

Residential sewage flow criteria are developed for use in design of pressurized sanitary sewers for hypothetical applications of the ASCE Project scheme. In a typical combined sewer area, data on domestic water demands is the most that can be expected to be available. On the basis of a study of winter water demand data it is concluded that projection of such observed demands for a service area to the end of the design period is the preferred basis of design. Data for California and the northeastern United States are presented separately. For each region, design curves represent the variation, as a function of the number of dwelling units served, of flows for the minimum 24 hours, for the peak hour of the minimum day, and for the maximum peak hour of any day, expressed as ratios to the annual average rate. (Tucker-ASCE)
W70-01061

PEAK FLOWS OF SEWAGE FROM INDIVIDUAL HOUSES,
American Society of Civil Engineers, New York.
Donald H. Waller.
Available from Clearinghouse as PB-186 015 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 9, Jan 1, 1968. 117 p, 45 fig, 23 tab, 15 ref. FWPCA Program No 11020 EKO.

Descriptors: *Peak discharge, *Water demand (Household), Data collections, Plumbing.
Identifiers: *Plumbing fixture tests, *Sewage flow (Household), *Synthesized peak discharges, Louisville (Ky), Sampling stations.

Sewage flows and water demands measured at two household observation stations, as well as water and wastewater flows from individual fixtures and appliances is used to estimate upper limits of pump and storage capacities for a storage-grinder-pump unit for individual homes and to examine the relationship between peak rates of sewage flow and corresponding water demand rates. For individual fixtures, combinations of rate, duration and frequency of discharge that will produce maximum hydraulic loading conditions are selected. Single-fixture hydrographs are combined to produce synthetic hydrographs of peak period sewage discharge, from which combinations of storage and pump capacities are derived. Peak sewage flows and simultaneous water demands for a fourteen day period at one house are presented and analysed. (Tucker-ASCE)
W70-01062

AN EXAMINATION OF THE BENEFITS AND DISADVANTAGES WITH RESPECT TO THE DISPOSAL OF SOLID WASTES,
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 05D.
W70-01063

CONVERGENT STILLING BASINS,
Liverpool Univ. (England).
R. B. Whittington, and K. H. M. Ali.
Inst Civ Eng Proc, Vol 43, p 157-173, June, 1969. 17 p, 18 fig, 2 tab, 8 ref.

Descriptors: *Stilling basins, Energy dissipation, Hydraulics, Foreign design practices, Supercritical flow, *Drowned (Submerged), Hydraulic jump, Froude number, Submergence, Spillways, Water surface profiles, Foreign research, Shock waves, Hydraulic models, Energy losses.
Identifiers: *Convergence, *Converging flow, Sweepout, Submerged flow, Great Britain.

Operation of convergent stilling basins in the drowned jump condition is discussed. Particular attention is paid to the occurrence of sweepout. When a basin is fully swept out, the flow in the basin remains supercritical, and the basin is then ineffective as an energy dissipator. A momentum equation is given for calculating the backing-up depth at the entrance to the basin; this yields good agreement with experimental results. The observed phenomena are compared to Ippen's fundamental work on oblique shock waves. Special reference is made to the stilling basin for the Llys-Y-Fran Dam under construction in Great Britain. (USBR)
W70-01099

HYDRAULIC PROPERTIES OF SMALL UNLINED ROCK TUNNELS,
Helsinki City Waterworks (Finland).
Seppo Priha.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 95, No HY4, p 1181-1209, July 1969. 29 p, 27 fig, 9 tab, 10 ref, 2 append.

Descriptors: *Water tunnels (Conveyance), *Tunnel hydraulics, Foreign design practices, *Tunnels, *Roughness (Hydraulic), Cross sections, Model tests, Reynolds number, Pressure tunnels, Hydraulic models, *Hydraulic properties.
Identifiers: *Unlined tunnels, Finland, *Friction coefficient (Hyd).

Factors influencing hydraulic characteristics of small unlined tunnel cross sections are presented. Investigations were performed in rock tunnels constructed by the Helsinki City Waterworks for conveying raw water. The length of the Silvola Reservoir entrance tunnel is 1.8 km; the theoretical cross section is 4.5 sq m. The length of the Silvola-Vanhakaupunki raw water tunnel is 7.6 km; the theoretical cross section is 6 sq m. Vertical shafts divided both tunnels into 3 parts, in all of which cross-sectional measurements and pressure loss measurements for different discharges were accomplished using measuring weirs and Siemens Venturi meters. All 3 tunnels were excavated by the so-called Swedish method in the most usual type of rock in Finland, composed mostly of granite and gneiss. (USBR)
W70-01115

ON THE CONCEPT OF MEAN HYDRAULIC RADIUS,
West Virginia Univ., Morgantown.
Desmond F. Moore.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 95, No HY4, p 1305-1319, July 1969. 15 p, 6 fig, 3 tab, 8 ref, 4 append.

Descriptors: *Hydraulic radius, Hydraulics, Open channels, Fluid flow, Open channel flow, Roughness coefficient, Roughness (Hydraulic), Viscous flow, Instrumentation, Laminar flow, Forecasting.
Identifiers: Aspect ratio, Rugosity, *Hydraulic diameter.

The flow rate through any channel may be predicted by using the hydrodynamic analogy between the torsion of a uniform bar with arbitrary cross section and viscous flow through a channel of the same shape. Parameters required are: (1) computation of the aspect ratio of the cross section of the channel; (2) measurement of the area using a

planimeter; (3) measurement of the wetted perimeter of flow; and (4) observation of the number of significant sides composing the cross section. The mean hydraulic radius may be obtained as the quotient of (2) and (3). The parameter is then modified by (1) and (4) to improve the accuracy of the prediction. The same concepts may be used for channels having variable shapes and sizes along their lengths. In such cases, an equivalent area is defined in the computation of hydraulic radius according to a method outlined in the appendix. Experimental support for the concepts proposed has been furnished from extensive tests using plates with regular and random asperites. The validity of the mean hydraulic radius concept has led to the development of a scientific outflow instrument capable of predicting the drainage ability of road surfaces subjected to pneumatic tire traffic. (USBR)
W70-01117

HEAD LOSSES CAUSED BY AN ICE COVER ON OPEN CHANNELS,
Worcester Polytechnic Inst., Mass.
Peter A. Larsen.
J Boston Soc Civ Eng, Vol 56, No 1, p 45-67, Jan 1969. 23 p, 20 fig, 4 ref.

Descriptors: *Head loss, *Energy losses, *Open channels, *Open channel flow, *Ice, Hydraulics, *Roughness coefficient, Hydraulic design, Water surface profiles, Roughness (Hydraulic), Canals, Mannings equation, Foreign research.
Identifiers: *Ice cover, Sweden.

A rational formula for composite roughness, based on the concept of logarithmic velocity distribution, was developed; field data relative to the roughness of the ice cover on 2 Swedish power channels are reported. The undersurface of ice on a channel had irregularities formed by the flowing water. The effect of these irregularities corresponds to a certain roughness expressible in terms of an equivalent roughness height. The mechanics of the formation are not known, and predicting the roughness of the ice cover on a channel of given hydraulic characteristics and climatic conditions is not possible. The formula derived for composite roughness is based on the assumption of 2 parallel (or slightly converging) boundaries, an assumption merely limiting the applicability to the case considered in this paper. The approach to this problem may be applicable in an attempt to develop a more general solution to the problem of composite roughness. The need for such a solution is obvious for design purposes and laboratory use; gathering field data on the ice cover roughness phenomenon should continue. (USBR)
W70-01126

NEW PROBLEMS IN THE THEORY OF BOTTOM CURRENTS IN RESERVOIRS,
Politekhnicheskii Institut, Leningrad (USSR).
I. I. Levi.
Transl from Russ, Bur Reclam Transl 784, Aug 1969. 19 p, 4 fig, 2 tab. Izv Vses Inst Gidrotekh, No 78, p 71-82, 1965.

Descriptors: Hydraulics, *Density currents, *Reservoirs, Mathematical analysis, Reservoir operation, Reynolds number, Laminar flow, Turbidity, Open channel flow, Velocity, Suspended sediments, Roughness (Hydraulic), Boundary layers, *Velocity distribution, Experimental data, Stratified flow, Foreign research, Depth, Currents (Water).
Identifiers: USSR, Reverse flow, Current patterns.

Bottom currents usually form in mountain reservoirs when the depth is greater than 30 to 40 m with suspended sediments of more than 3 to 4 kg/cu m. Unit discharges and depth of water can reach large magnitudes. Under these conditions, the assumption of disregarding movement in the upper zone of the reservoir cannot always be considered valid. The problem of velocity distribution in reservoirs during formation of bottom currents is examined. Differential equations are given for determining the movement of the bottom flow. Values are established for the normal and critical depths of bottom flow, surface velocities, reverse flows, and the line of zero velocities. Equations are derived for a reservoir with a horizontal bottom. The analysis broadens concepts of steady, nonuniform motion of fluids of different densities in reservoirs, making possible a mathematical determination of velocity distribution curves and line of zero velocity in reservoirs. (USBR)
W70-01129

CHARACTERISTIC PRESSURE DISTRIBUTION IN OUTLET WORKS INLETS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Robert G. Cox, and Yen H. Chu.
Miscellaneous Paper H-69-8, Sept 1969. 12 p, 24 fig, 17 ref.

Descriptors: *Outlet works, *Intakes, *Pressures, Hydraulic models, Flow.

Report summarizes a study of inlet pressures measured in nine hydraulic models and two laboratory investigations of entrance designs for flood control outlet works. The experimental data are examined to determine the effects of upstream face geometry, guide piers, and bulkhead and gate slots. Both two-dimensional and three-dimensional flow inlets are considered and compared with free-streamline inlets. The results are presented graphically in terms of dimensionless pressure drop coefficients for use in estimating pressure conditions to be expected in design practice. Design criteria are recommended. (Spivey - Waterways Experiment Station)
W70-01222

SPILLWAY FOR REND LAKE RESERVOIR, BIG MUDDY RIVER, ILLINOIS; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Bobby P. Fletcher, and John L. Grace.
Sponsored by US Army Engineer District, St. Louis. Technical Report H-69-7, May 1969. 15 p, 1 tab, 7 photo, 11 pl.

Descriptors: *Spillways, *Hydraulic models, Stilling basins, Riprap, Flow, Channels, Laboratory tests.
Identifiers: *Rend Lake Reservoir, Big Muddy River.

Test of spillway were conducted with a 1:16-scale model that reproduced a 129-ft length of the 435-ft-long main spillway to study adequacy of spillway, stilling basin, and exit channel protective stone. After completion of tests concerned with the notched portion of spillway, the notch was filled in and the model revised to permit study of flow conditions at right abutment. Approximately 250 ft of approach channel and 500 ft of exit channel were reproduced. Particular emphasis was placed upon selection of a stilling basin downstream of the notched section. Flow conditions in the approach, at the right abutment, and over the main spillway were satisfactory. Capacity of the spillway as determined by the model was approximately the same as computed. Performance of the original stilling basin was unsatisfactory in dissipation of all spillway discharges due primarily to high unit discharge through the notched section. Four alternate designs were investigated and a stilling basin was developed which proved satisfactory. Model tests indicated that riprap proposed in the approach for the original design was adequate. (Spivey - Waterways Experiment Station)
W70-01223

8C. Hydraulic Machinery

ADVANCED DEVELOPMENT OF HOUSEHOLD PUMP-STORAGE-GRINDER UNIT (TASK 6),
American Society of Civil Engineers, New York.
R. Paul Farrell.
Available from Clearinghouse as PB-186 004 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, General Electric Co Report No S-69-1038, Dec 1968. 74 p 22 fig, 7 tab, 10 ref. FWPCA Program No 11020 EKO.

Descriptors: *Capital costs, *Design, *Installation costs, *Operating costs, Performance, Pump.
Identifiers: *Check valve, *Development, *Grinding, Storage-grinder-pump.

This report describes the development, by the General Electric Company for the ASCE Project, of a 150-pound household storage-grinder-pump unit comprising a domestic sewage grinder and progressing-cavity pump driven by a 1-h.p., 1725-r.p.m. motor, and mounted on a 58-gallon receiver tank, meeting criteria established by the Project investigation. The unit is capable of discharging through a backflow valve and 1 1/4-in. outlet at 15-gpm at atmospheric pressure and 11-gpm at 35 psig pressure. The estimated cost of the unit without tank is $343, and estimated total installed costs are $548 for new work and $648 where cutting and patching are involved. Cost of energy for operation is about $2 per year. (Tucker-ASCE)
W70-01048

EXPERIENCE WITH GRINDING AND PUMPING OF SEWAGE FROM BUILDINGS,
American Society of Civil Engineers, New York.
Donald H. Waller.
Available from Clearinghouse as two reports as PB-185 997 and PB-185 998 at $3.00 in paper copy or $0.65 in microfiche per report. ASCE Combined Sewer Separation Project, Technical Memoranda Nos 3 May 1, 1967, and 3A, Mar 1, 1968. 102 p and 47 p respectively. FWPCA Program No 11020 EKO.

Descriptors: *Maintenance, *Operations, *Pumping, Pipes, Valves, Water reuse.
Identifiers: *Comminutors, *Garbage grinders, Liljendahl, Vacuum system.

In TM No. 3, a typical garbage grinder is described and use of grinders for toilet wastes is reviewed. Two wet process building-waste pulping systems and two machines that combine the functions of grinding and pumping are described. Practice in the use of pumps, piping and backflow valves for sewage in buildings is reviewed. An appendix describes the Liljendahl vacuum sewerage system. Results of monitoring the operation of thirty-six comminutor installations that serve individual buildings are reported in TM No. 3A. The monitoring program, which covered periods of up to sixteen months, is described. Descriptions and prior operating histories of the installations are included. Frequency of attention and maintenance is recorded and compared with manufacturers' recommendations. Twenty-five of the machines were inspected at least five times each week. Twenty-four of the installations include sewage pumps following the comminutors with discharge mains 3 to 6 inches in diameter. An appendix contains a summary description of a system developed at Pennsylvania State University for conservation of water in residences by recycling. (Tucker-ASCE)
W70-01056

HYDRAULICS OF A PRESSURIZED SEWERAGE SYSTEM AND USE OF CENTRIFUGAL PUMPS,
American Society of Civil Engineers, New York.
L. Scott Tucker.
Available from Clearinghouse as PB-186 012 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 6, Nov 15, 1967. 35 p, 14 fig, 1 tab, 12 ref. FWPCA Program No 11020 EKO.

Descriptors: *Pumps (Centrifugal), Flow characteristics, Hydraulics.
Identifiers: *Pump characteristics, Control valves, Pressure sewers, Total dynamic head.

Hydraulic gradients for high and low sewage flows and the use of pressure control devices for service zones and interceptors applicable to pressure sewer systems are illustrated and discussed. For some flat drainage areas sewage pumping, in addition to pumping provided by pumps located in buildings, would be necessary; a pressure control assembly would be needed immediately upstream and a surge control valve would be used immediately downstream of a lift station. For steep drainage areas, pressure control assemblies would be needed to limit maximum pressures. Centrifugal pump characteristics are discussed and information on thirty-two classes of sewage and solids handling pumps is tabulated. Characteristics for centrifugal pumps capable of pumping sewage are such that maximum reasonable limits on discharge rates would be greatly exceeded if variations in total dynamic head were allowed to equal curb pressure variations that are expected in some parts of a pressure sewer system. Ordinary use of centrifugal pumps in these cases would be precluded. A possible modification of building pumping systems with a valve controlled to maintain a constant discharge pressure is discussed, together with the use of variable speed drivers. (Tucker-ASCE)
W70-01059

CONTROL TECHNIQUES FOR PRESSURIZED SEWERAGE SYSTEMS,
American Society of Civil Engineers, New York.
James R. Daneker, and William H. Frazel.
Available from Clearinghouse as PB-186 007 at $3.00 in paper copy or $0.65 in microfiche. ASCE Combined Sewer Separation Project, Technical Memorandum No 11, Mar 4, 1968. 27 p, 11 fig. FWPCA Program No 11010 EKO.

Descriptors: *Butterfly valves, Pressure conduits, Venturi meters.
Identifiers: *Control systems, *Flow control, *Pressure control, Electronic systems, Fail safe designs, Hydro-electric systems, Hydro-pneumatic systems, Magnetic flow meter, Peumatic systems, Tranducers.

Instrumentation and control of a pressurized sewer system can be attained with current technology, and special designs are foreseen that can approach zero maintenance. A rubber-seated butterfly valve is recommended for the basic control element. For 'system No. 1' a fixed pressure is maintained upstream of the control valve by modulation of the valve to correct or reduce any deviation of measured pressure from a selected set point. A pressure sensing element would be directly connected to the control valve. For 'system No. 2' the control valve would be modulated to maintain a specific upstream pressure corresponding to every rate of flow measured at a flow sensing element. A venturi type or magnetic meter could be used for measurement of flow, and a transducer (with a changeable cam that could be cut in the field) would be required to generate some characterized signal that would actuate the control valve. 'System No. 3' would apply to a booster or lift station and the start-stop sequence of a centrifugal pump would be controlled to permit starting without surge and to maintain a constant discharge pressure. For a booster station the pump speed would be varied in response to suction pressure. For nearly fool-proof fail-safe control, all-hydraulic control systems are recommended in preference to pneumatic, hydro-pneumatic, or electronic systems. (Tucker-ASCE)
W70-01064

PHOTOGRAMMETRIC MEASUREMENT OF ROCK SURFACES IN A POWER TUNNEL,
Imperial Coll. of Science and Technology, London (England); Binnie and Partners, London (England); and Fairey Surveys Ltd. (Gr. Brit.).
For primary bibliographic entry see Field 07B.
W70-01090

ELECTRICAL DESIGN OF PARAMETERS USED FOR EHV SYSTEMS,
Westinghouse Electric Corp., Pittsburgh, Pa.
C. L. Wagner.
Transm Distrib, Vol 21, No 6, p 63-69, June, 1969. 7 p, 6 fig, 2 tab, 9 ref.

Descriptors: *Extra high voltage, *Transmission lines, Conductors, *Electrical design, Systems analysis, Lightning arresters, Economics, Electrical coronas, Radio interference, Electric insulation, Costs, Electrical insulators, Electrical equipment, Transmission (Electrical).
Identifiers: *Ultra high voltage, Switching surges, Short circuits, Transient stability, Lightning surges, Withstand level (Electric).

Electrical design of ehv systems can be separated into 4 parts: system analysis, conductor specification, line insulation, and equipment insulation. Although based on 500-kv system studies, the methods discussed apply to all ehv and uhv systems, and might be used for systems of 230 kv and below. Examples used are results of 500-kv design studies. Various factors concerning transmission system analysis are discussed. Conductor selection for ehv is dependent upon several interrelated variables considered from the overall operating and economic aspect. Line insulation requirements depend upon normal and transient conditions. Transmission lines designed for satisfactory lightning and switching surge performance are adequate for 60-hz conditions. The correct insulation level for equipment is an important application problem in ehv. A general method for determining correct insulation and results therefrom are summarized. (USBR)
W70-01093

UPLIFT RESISTANCE OF ANCHOR BAR, AUGER AND PRESSED PLATE FOOTINGS IN SANDY SILT,
Bureau of Reclamation, Denver, Colo.
James M. Horner.
Bur Reclam Rep No EM-768, May, 1969. 60 p, 43 fig, 5 tab, 1 ref, append.

Descriptors: Field tests, *Footings, Transmission towers, Silts, Loads (Forces), Movement, Soil properties, Soil mechanics, Soil tests, Lateral forces, Geometry, Arizona, Ponding, Soil strength, Shear strength, Soil moisture, Sands, *Anchored towers.
Identifiers: Mead-Liberty Transmission Line, *Uplift resistance, Pullout tests, Belled footings, *Anchored footings, Auger-type footings.

Four types of transmission tower footings were tested under uplift loads to determine load-movement performance. The performance of the anchor bar footing in sandy silt was of special interest. The straight auger, belled auger, and pressed plate footings were tested to provide a comparison with the anchor bar footing results. Each footing was tested in natural and ponded soils conditions. For the anchor bar footing at vertical failure movement (1/2 in.), the load resisted was over 110 kips in natural soil and about 115 kips in ponded soil. For the other 3 types of footings, loads at vertical failure movement were: 55 to 105 kips for straight auger, 80 to 100 kips for belled auger, and 17.5 to 25.0 kips for pressed plate. Design loads were 28.7 kips for concrete footings and from 14.1 to 18.0 kips for pressed plate footings. Soil samples were analyzed in the laboratory. A method of predicting failure loads for the anchor bar footings using the soil test results was attempted, but no consistent results were obtained. (USBR)
W70-01096

FIELD TEST RESULTS ON 113,000 KW FRANCIS PUMP-TURBINES FOR NAGANO POWER STATION,
Electric Power Development Co. (Japan); and Hitachi Ltd., Hitachi City (Japan).
Katsuro Suzuki, and Kakehiko Yamamoto.
Hitachi Rev, Vol 18, No 6, p 228-234, May, 1969. 7 p, 14 fig, 1 tab, 5 ref.

Descriptors: *Pump turbines, *Field tests, *Performance tests, Test procedures, Model tests, Prototype tests, Noise, Reduction, Water hammer, Vibrations, Characteristics, Calculations, Electronic equipment, Computers, *Francis turbines, Hydraulic turbines.
Identifiers: *Test results, Japan foreign testing, Load rejection, *Reversible turbines.

Results of field tests conducted on the 113,000-kw, 111-m-head, reversible pump turbines for Nagano Powerplant, Japan, are discussed. These units are the largest of their kind in Japan and went into commercial operation in July 1968. Before manufacturing the equipment, various site operation tests were conducted; results were considered carefully with those of various model tests performed prior to manufacture of the prototype pump turbines to determine operational performance of the units. Principal data gained are discharge-versus-power characteristics, starting characteristics, transient phenomena at load and input rejection, and vibration information. Partial-load noise in the turbine was studied. Improvement in runner cone design was the most effective method of noise reduction. Changeover time from one mode of operation to the other was measured. (USBR)
W70-01097

IMPROVED DIGITAL SIMULATION FOR ANALYZING POWER SYSTEM DISTURBANCES,
Westinghouse Electric Corp., Pittsburgh, Pa.
C. J. Baldwin, and R. T. Byerly.
Westinghouse Eng, Vol 29, No 4, p 109-116, July 1969. 8 p, 8 fig.

Descriptors: *Electrical studies, *Digital computers, *Power system operations, *Electrical stability, *Simulation, *SComputers, Direct current, Computer programming, Transmission lines, Alternating current, Analysis, Excitation, Electric Power production, Governors, Hydroelectric power, Thermal power, Electric relays, Voltage regulators, Disturbances.
Identifiers: *Power system stability, *Interconnected systems, Load shedding, Synchronous machines, System stability (Elect).

A digital computer program incorporating recent advances in power systems analysis techniques provides a powerful tool for studying system stability following a fault or loss of generation, transmission, or load. Stability can be evaluated effectively by this new program, accommodating as many as 2000 buses, 3000 lines, and 600 generating units. Systems having 100 generating plants have been studied by this method. The increased size and detail of the new system simulation program is made possible by the availability of new large-memory digital computers. This new approach to systems analysis is discussed and sample output tabulations for simulations made with the computer program are given. Interconnection planning studies in the western United States have given momentum to much of the program development in recent years. (USBR)
W70-01105

INCREASING THE CAVITATION RESISTANCE OF PARTS BY USING EXPLOSIVE-WELDED FACINGS,
A. S. Gel'man, N. I. Pylaev, and B. D. Tsemakhovich.
Transl from Russ, Bur Reclam Transl 462, Aug 1969. 9 p, 1 fig, 3 ref. Energomashinostr, No 12, p 34-35, 1967.

Descriptors: *Manufacturing, *Cavitation, *Hydraulic turbines, Turbine parts, Turbine blades, Laboratory tests, Testing machines, Adhesion, Test procedures, Foreign research, *Welding, Stainless steel, Materials testing, Metals treatment, *Metal coatings, Heat treatment.
Identifiers: USSR, *Explosive welding, *Cavitation control, *Cladding, *Cavitation resistance, Metal bonding, Low carbon steel.

Facing metal parts by explosive welding of stainless steel strips to low-carbon steel base of machinery

parts has been developed and tested by several USSR institutes. Because of the degree to which the Francis and Kaplan turbine water passages are subject to cavitation, recent testing was conducted to study the effect of explosive welding cladding of blades on cavitation resistance. In explosive welding, the charge is deposited uniformly on the facing surface some distance from the part being clad. The explosion moves the facing at great speed toward the part. A pressure of 100,000 atm causes a jet to be thrown out of the contact zone, carrying with it acids and waste products. High pressure and plastic shear cause the metal to turn to a semiliquid state, forming a strong bond. Advantages are: removing the need for heating welded parts, welding metal difficult to weld normally, and attaining high static and fatigue strength of faced parts. Cavitation resistance of specimens faced with the stainless steels tested by explosive welding is not inferior to the initial resistance of these steels. Explosive welding produces a strong welded bond meeting conditions of repeated and variable microimpacts. (USBR)
W70-01127

WATER-POWER DEVELOPMENT, CONSERVATION OF HYDROELECTRIC POWER DAMS AND WORKS.
For primary bibliographic entry see Field 06E.
W70-01175

RIGHT OF EMINENT DOMAIN OF PUBLIC SERVICE CORPORATIONS.
For primary bibliographic entry see Field 06E.
W70-01176

8D. Soil Mechanics

CERTAIN ASPECTS OF ENGINEERING GEOLOGY IN PERMAFROST,
Army Terrestrial Sciences Center, Hanover, N.H.
G. K. Swinzow.
Eng Geol, Vol 3, No 3, p 177-215, July 1969. 39 p, 12 fig, 3 tab, 51 ref.

Descriptors: *Permafrost, *Engineering geology, *Frozen ground, *Rheology, Mining engineering, Tunnels, Frost heaving, Soil mechanics, Ice, Freezing, Thawing, Soil types, Foundation investigations.
Identifiers: Permafrost engineering.

The principal topics of engineering geology in permafrost are reviewed. Permafrost is defined and soil mechanical properties, rheology, patterned ground, ice wedges, pingoes, and icings are described. Although the strength of frozen soil is much greater than that of unfrozen soil, frozen soil creep and movement of thawed permafrost are severe engineering problems to be solved. Tunneling and mining problems, highway construction, road building, and airfield building and operation are briefly described. (Knapp-USGS)
W70-01011

DETERMINING PORE PRESSURE IN SLIGHTLY PERMEABLE SOILS IN THE BODY OF A DAM DURING THE PROCESS OF THEIR CONSOLIDATION,
A. A. Nichiporovich, and T. I. Tsybul'nik.
Translated from Trudy VIDGEO, No 4, p 5-37, 1963. Bur Reclam Transl 561, July 1969. 40 p, 23 fig, 5 tab, 18 ref.

Descriptors: *Pore pressure, *Earth dams, Cores, Consolidation, Creep, Soil moisture, Experimental data, Investigations, Calculations, Moisture content, Filtration, Plasticity index, Foreign research, Soils, Stress, Yield point, Soil mechanics, Saturation, Groundwater, Bibliographies, Soil density, Mathematical analysis.
Identifiers: USSR, Hydrodynamic pressures, Dynamic loads, Nurek Dam, USSR, Finite difference method.

When erecting comparatively high dams from local materials, the profile of which contains a core made from soil having a low filtration coefficient, excess pore pressure builds up in these soils during consolidation. During periods of construction and operation of the dam, the resistance to creep depends on the magnitude of the pore pressure; the greater the pore pressure, the lower the resistance of the tenacious soils to slip. An especially high pore pressure can occur either in soils under the effect of high stresses occurring in high dams or with comparatively low stresses but in insufficiently dense and waterlogged soil. The existing theoretical and experimental methods of determining pore pressure are analyzed and experiments for determining the pore pressure are described. Validity for using this index as a function of soil density and moisture in designing earth dams in confirmed, but different methods should be used on various types and dimensions of earth dams. The distinctive features of each method are given. Pore pressure diagrams are presented from determinations made under laboratory conditions; data are compared with those for the Nurek Dam, USSR. (USBR)
W70-01091

ADVANTAGES AND LIMITATIONS OF THE OBSERVATIONAL METHOD IN APPLIED SOIL MECHANICS,
Illinois Univ., Urbana.
R. B. Peck.
Geotech, Vol 19, No 2, p 171-187, June, 1969. 17 p, 7 fig, 8 ref.

Descriptors: *Soil mechanics, Construction, Foundations, Design, Earth dams, Dam design, Foundation investigations, Design criteria, Subsurface investigations, Foundation failure, Optimum design, Pore pressure, Soil stabilization, Subsidence, Settlement (Structural), Change orders, Structural stability, Engineering geology.
Identifiers: Terzaghi, *Observational method, Rankine lectures, Cost savings, Problem solving, Progressive failures.

The observational method, used so successfully by Terzaghi in applied soil mechanics, often permits maximum economy and assurance of safety, provided the design can be modified as construction progresses. Essential features of the method are set forth and examples of the application are given. The method is not without pitfalls and limitations. It should not be used unless the designer has a plan of action in mind for every unfavorable situation that might be disclosed by the observations. The observations must be reliable, reveal the significant phenomena, and be so reported as to encourage prompt action. The possibility of progressive failure may introduce a serious element of uncertainty. The essential ingredient is the visualization of all possible eventualities and the preparation in advance of courses of action to meet whatever situation develops. In spite of the limitations of the observational method, the potential for saving time and money without sacrificing safety is so great that engineers dealing with applied soil mechanics should be informed of the principal features of the method. (USBR)
W70-01092

A SEMI-EMPIRICAL METHOD FOR DETERMINING STRESSES BENEATH EMBANKMENTS,
Middle East Technical Univ., Ankara (Turkey).
T. Mirata.
Geotech, Vol 19, No 2, p 188-204, June, 1969. 17 p, 8 fig, 15 ref.

Descriptors: Soil engineering, Soil mechanics, Earth dams, Foreign design practices, Earth materials, Earth movements, *Embankments, *Foundations, *Stress analysis, Calculations, Displacements, *Stress, *Deformation, Bibliographies, Shear stress, Settlement (Structural), Shear.
Identifiers: Embankment subsidence, Turkey, Horizontal displacements, Vertical displacements.

Available methods for complete solution of stresses and displacements within and beneath embankments are either experimental or numerical, involving recourse to a digital computer with all the necessary ancillary work. Calculating settlements and lateral deformations using a slide rule and a few tables and charts results in making oversimplifying assumptions that may lead to unnecessarily high errors. A semi-empirical method is presented to bridge the gap between intricate computations and intolerable inaccuracy in determining deformations beneath embankments. The method requires no specialized training and yields reasonably accurate results. Attention is concentrated on foundation stresses, but the procedure can be used for estimating vertical and horizontal stresses within the embankment. The method is applicable to embankments on semi-infinite foundations and those resting on an elastic layer. (USBR)
W70-01102

CONTROLLING THE EXPANSION OF DESICCATED CLAYS DURING CONSTRUCTION,
Bureau of Reclamation, Denver, Colo.
J. P. Bara.
Pap, Second Int Res Eng Conf Expansive Clay Soils, Texas A and M Univ, College Station, Aug 1969. 27 p, 10 fig, 14 ref.

Descriptors: *Expansive clays, Canals, *Canal construction, Shrinkage, Canal design, *Canal embankments, *Foundation investigations, Moisture content, Central Valley Project, Soil moisture, Soil stabilization, Soil tests, Liquid limits, Canal linings, Sprinkling, Compaction, California, Construction, Cracks, Ponding, Ponding tests, Soil mechanics, Control.
Identifiers: *San Luis Unit (Calif), Desiccation, *Controlled expansion.

Expansive clays have been creating foundation problems in construction for centuries. Canal performance records show that continuous concrete linings can be virtually destroyed by expanding clay foundations unless precautions are taken. Control measures developed for identifying and reducing the expansive potential of foundation clays are described. These methods are being used by the Bureau of Reclamation in constructing the San Luis Drain, San Luis Unit, Central Valley Project, Calif. Three schemes for stabilizing expansive clays are discussed. Foundation soils for the San Luis Drain were investigated; foundation moisture control criteria were developed; test sections were established to evaluate construction methods; control requirements for embankments built of fat clay were established; and construction procedures for controlling expansion of clay foundations and embankments were developed. (USBR)
W70-01112

DECKED ROCKFILL DAMS,
Hydro-Electric Commission, Tasmania.
J. K. Wilkins.
Inst Eng, Aust Giv Eng Trans, Vol CE 10, No 1, p 119-129, Apr 1968. 11 p, 17 fig, 2 tab, 10 ref, 3 append, disc.

Descriptors: *Rockfill dams, *Impervious membranes, Cutoffs, Reviews, Dam foundations, Impervious blankets, Dam design, Shear strength, Dams, Asphaltic concrete, Density, Settlement, Compaction, Foreign design practices, Strain, Stress, Deformation, Calculations, *Membranes, Reinforced concrete, Small structures.
Identifiers: *Dam facings, Australia, *Facings.

The concept of building a dam by making a bank of gravel or rock and covering the upstream face with a waterproof membrane or deck is simple. Successful small dams of this type have been built in many parts of the world. No design of a mathematical nature is necessary if (1) the foundation is hard (compacted gravel or rock), (2) the fill material is strong, (3) an adequate cutoff to impervious material is constructed, (4) the membrane is reasonably watertight, (5) the dam is low

preferably below 50 ft high), and (6) the slopes are no steeper than 37 deg to the horizontal. Existing design and construction practices are reviewed and troubles arising from decked rockfill dams discussed. A method of computing strains and stresses in the decking material caused by movements of the fill was developed. Comparisons are made between computed strains and strains recorded at Salt Springs Dam in the U.S. Recommendations are given for reducing cost and improving the performance of concrete-faced and asphaltic-concrete-faced dams. (USBR)
W70-01121

MULTISENSOR ANALYSIS FOR SOILS MAPPING,
Bureau of Public Roads, Washington, D.C.; and Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 07B.
W70-01125

8E. Rock Mechanics and Geology

GEOLOGY, PETROLEUM DEVELOPMENT, AND SEISMICITY OF THE SANTA BARBARA CHANNEL REGION, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-00836

THE RELATIONSHIP BETWEEN THE ULTIMATE RESISTIVITY OF CLAYEY SANDSTONES AND THEIR POROSITY AND CLAY CONTENTS (RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Geofizicheskikh Metodov Razvedki, Moscow (USSR).
For primary bibliographic entry see Field 07B.
W70-00876

ESTIMATION OF CLAY CONTENT OF SAND FORMATIONS FROM WELL-LOGGING DATA (RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Geofizicheskikh Metodov Razvedki, Moscow (USSR).
For primary bibliographic entry see Field 07B.
W70-00877

THE SEISMIC DESIGN STUDY OF A DOUBLE CURVATURE ARCH DAM,
Gibb (Alexander) and Partners, London (England); Imperial Coll. of Science and Technology, London (England); and Bristol Univ. (England).
For primary bibliographic entry see Field 08A.
W70-01094

STRENGTH OF DISCONTINUOUS ROCKS IN DIRECT SHEAR,
New Brunswick Univ., Fredericton.
E. Z. Lajtai.
Geotech, Vol 19, No 2, p 218-233, June, 1969. 18 p, 18 fig, 7 ref.

Descriptors: *Shear strength, Shear stress, Shear tests, Shear planes, *Shear failures, Rock mechanics, Tensile strength, *Direct shear, Joints (Geology), Fractures (Geology), Friction, Internal friction, Strength of materials, Failure (Mechanics), *Discontinuities, *Rocks.
Identifiers: Weakness planes, Foreign testing, Canada, Rock tests, Ultimate strength.

The strength of discontinuous rocks under direct shear loading is examined analytically and experimentally. In the direct shear test, a homogeneous and isotropic block of rock may fail by 3 mechanisms: failure in tension, failure in shear, and failure at ultimate strength. Strength parameters include tensile strength, fundamental shear strength (cohesion), angle of internal friction at ultimate strength, and the normal stress on plane of enforced shear. The direct shear strength of planes of weakness, oriented in the plane of enforced shear, is derived from the strength of soild rock and joint friction along the separated parts of the shear surface. Maximum shear strength develops only if soild strength and joint friction are mobilized simultaneously at the same deformation. (USBR)
W70-01101

A LABORATORY INVESTIGATION OF BOREHOLE STABILITY,
Shell Development Co., Modesto, Calif.
H. C. H. Darley.
J Petrol Technol, p 883-892, July 1969. 10 p, 9 fig, 4 tab, 6 ref.

Descriptors: *Shales, *Boreholes, *Drill holes, Rock properties, Drilling, Drilling fluids, *Expansion, *Deformation, Swelling, Stability, Montmorillonite, Laboratory tests, Collapse, Failure (Mechanics), Permeability, Failures, Earth pressure.
Identifiers: Spalling, Unstable ground.

The principal causes of unstable boreholes and the classes of troublesome shales have been known for many years, but there still are difficulties in identifying the cause of hole problems and consequently in selecting the right technique for combatting them. A laboratory study was undertaken on the basic mechanisms causing borehole instability in shales. The chemistry and physics of shales are reviewed, tests are developed for characterizing shales, and a model was constructed to study borehole stability. Reconstituted shale specimens were subjected to triaxial stresses and various fluids were circulated through an axially drilled hole in the specimen. The experimental program established 3 particular failure mechanisms: changes in borehole diameter caused by swelling, hole enlargement in brittle shales, and instability caused by high earth stresses. (USBR)
W70-01107

HYDRAULIC DESIGN OF UNLINED ROCK TUNNELS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Carl J. Huval.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 95, No HY4, p 1235-1246, July 1969. 12 p, 5 fig, 2 tab, 24 ref, 2 append.

Descriptors: Hydraulics, *Tunnel hydraulics, *Tunnels, *Hydraulic design, Overbreak, *Tunnel design, Flow resistance, Mannings equation, Roughness coefficient, Hydraulic structures, Overexcavation, Linings correlation techniques, Diversion tunnels, Hydroelectric power, Water tunnels (Conveyance), Water tunnels (Testing), Bibliographies, Rocks.
Identifiers: *Unlined tunnels, Rock traps.

Many unlined rock tunnels have been built for flood flow diversion and for hydropower tunnels where the rock is of sound quality and not greatly jointed and fractured. The number of unlined rock tunnels will increase in the years ahead because new methods of drilling, blasting, and muck removal have been developed and improved to make tunnel construction more economical. Methods of tunnel stabilization, such as grouting and use of rock bolts, have been improved so that many kinds of rock and difficult driving conditions can be handled more flexibly. Savings of unlined rock tunnels in time and cost of construction have been demonstrated by the ready acceptance of this type of tunnel in Sweden, Norway, Australia, and the United States. Unlined rock tunnel resistance coefficients can be predicted by using a rock overbreak parameter. The important considerations entering into design of unlined rock tunnels are summarized. The present method of predicting hydraulic resistance is inadequate. A study of tunnel rock overbreak experience leads to a relation between rock overbreak and tunnel size. This measure of rock overbreak provides a simple correlation of flow resistance test results based on the fully rough flow equation. (USBR)
W70-01114

RELATION BETWEEN THE STATIC AND THE DYNAMIC DEFORMATION INDEXES OF ROCK IN LARGE-SCALE TESTS ON ROCK MASSES,
S. B. Ukhov, and A. S. Panenkov.
Hydrotech Constr, No 11, p 996-1001, Nov 1968. 6 p, 5 fig, 13 ref.

Descriptors: *Rock foundations, *Rock mechanics, Dam foundations, Test procedures, Foundation investigations, Field tests, Static tests, Rocks, Field investigations, *Deformation, *Elasticity modulus, Experimental data, Correlation techniques, Fissures (Geology), Engineering geology, Rock properties, Sandstones, Schists.
Identifiers: *Deformation modulus, Rock tests, USSR, Foreign testing, *Plate load tests, Ultrasonic tests, Dynamic tests, In situ tests.

A correlation between dynamic modulus of elasticity and the static moduli of total deformation was established on large-scale tests of rock foundations. Static and dynamic tests were made in adits in the foundation rock of Andizhansk and Kirovsk Dams in the USSR. Static moduli of deformation were determined by applying loads of 40 kg/sq cm through concrete plates. Dynamic moduli were determined by ultrasonic instruments operating at frequencies of 25 to 100 kc/sec. The instruments were placed in boreholes drilled along the perimeter of the concrete loading plate. Tests were made on 5 types of rock: massive sandstone, laminated sandstone, and 3 types of schist. An analysis of experimental techniques and principles of test data interpretation was made in evaluating the relation between static and dynamic deformation indexes. The application of indirect and direct correlation techniques is discussed. Results obtained by direct correlation of experimental data show good agreement. The proposed correlation may be used in investigating deformation indexes of fissured rock masses under standardized static testing conditions. (USBR)
W70-01124

8F. Concrete

CRACKS IN BLOCKS OF THE BRATSK HYDROELECTRIC STATION DAM,
S. Ia. Eidel'man, and L. P. Trapeznikov.
Transl from Russ, Bur Reclam Transl 691, July 1969. 20 fig, 2 tab, 22 ref. Izv Vses Nauch-Issled Inst Gidrotekh, Vol 79, p 41-70, 1965.

Descriptors: *Cracks, *Concrete dams, Creep, Strain gages, Expansion, Stress, Tensile stress, Plastic deformation, Deformation, Heating, Test procedures, Temperature, Foreign research, Safety factors, Construction joints, Compression, Tensile strength, Instrumentation, Bibliographies, Concrete technology, Foreign projects.
Identifiers: *Crack control, USSR, Crack propagation, Foreign testing, *Bratsk Dam (USSR), Test results, Cold climates.

Preventing temperature cracks in mass concrete has always been a problem in dam construction. Intensive cracking of early dams stimulated theoretical and experimental studies, and engineering measures were devised for maintaining the monolithic nature of concrete dams. These measures, including concrete temperature control and breaking the structure by joints, have reduced temperature cracking. Results of field observations on temperature cracking in the massive concrete dam at Bratsk, USSR, and the factors causing these cracks are analyzed. Many remote-controlled strain gages embedded in the blocks of the dam for studying internal stress conditions were either in or near the cracks. This permitted determining the moment of cracking, the stress condition prior to this process,

and the dynamics of crack development. Of particular interest are the data on internal cracks, unobtainable through ordinary visual observations. (USBR)
W70-01119

8G. Materials

ON THE POSSIBILITY OF ESTIMATING THE THICKNESS OF UNCONSOLIDATED ROCKS BY VERTICAL ELECTRICAL SOUNDING IN PERMAFROST AREAS (RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Geofizicheskikh Metodov Razedki, Moscow (USSR).
For primary bibliographic entry see Field 07B.
W70-00878

8H. Rapid Excavation

ELECTRON BEAMS APPLY AN OLD PRINCIPLE TO MODERN ROCK-BREAKING,
Westinghouse Electric Corp., Pittsburgh, Pa.
B. W. Schumacher.
Eng Mining J, Vol 170, No 6, p 116-119, June, 1969. 4 p, 7 fig, 1 tab.

Descriptors: *Rock excavation, Rocks, Rock mechanics, *Electron beams, Engineering geology, *Cutting, Drilling, Drilling equipment, Electrons, Concretes, Melting, Tunneling, Penetration, Vaporization, Construction, Quarrying.
Identifiers: *Rock breakage, Rock tests, Cutters, *Electron (Beam cutting), Underground openings.

An electron-beam cutter offers the prospects of reduced costs and increased speed in tunneling and other hard-rock excavation operations. The present electron gun has a power of 10 kw, operates at 150 kv, and produces a focused electron beam having a power density of 1 million w/sq cm in the focal spot. The electron beam penetrates rock 0.01 cm deep. The kinetic energy of the electrons is dissipated almost instantly, giving an energy propagation much faster than could ever be accomplished by heat conduction. The rock surface layer melts in 15 micro-sec. The melt-front would propagate at a rate of 6.6 m/sec if the molten target material could be removed quickly. The molten material normally is unable to flow away fast enough, and is further heated by the electron beam and vaporized. Vapor pressure and vaporization rate increase exponentially with temperature, permitting rapid removal of material. Thermal effects can significantly augment melt cutting, producing sufficient stress to completely fragment the rock. Melt cutting and rock breaking tests in the laboratory are discussed. The energy efficiency of the electron beam method is very high, competitive with conventional methods, and far superior to some of the newer experimental methods. Equipment and maintenance costs are expected to be low. (USBR)
W70-01109

10. SCIENTIFIC AND TECHNICAL INFORMATION

ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION, 1963-65, UNITED STATES AND CANADA.
Engineering-Science, Inc., Los Altos, Calif.
For primary bibliographic entry see Field 02J.
W70-00837

THE CLIMATE OF CITIES: A SURVEY OF RECENT LITERATURE,
National Air Pollution Control Administration, Raleigh, N.C.
James T. Peterson.
Nat Air Pollut Contr Admin Publication No AP-59, Oct 1969. 48 p, 7 fig, 6 tab, 127 ref.
Descriptors: *Climates, *Climatic data, *Cities, *Publications, Surveys, Climatic zones, Precipitation (Atmospheric), Humidity, Temperature, Radiation, Winds, Air pollution, Water vapor, Meteorological data.
Identifiers: *Urban climatology, *Urban-rural climates, Literature survey, Metropolitan studies.

City climate differs from the surrounding rural areas; increasing scientific research devoted to comparative studies of urban and rural climates point up this difference. This report reviews the literature on city climatology, particularly that written since a series of papers published by Dr. H. Landsberg (1956 to 1962). The Landsberg papers serve as a standard and provide the basis for this report on city-rural meteorological differences. Meteorological aspects discussed in the report include temperature, humidity, precipitation, radiation, wind, and visibility. (Lang-USGS)
W70-00988

WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH; LIST OF LITERATURE ON THE EFFECT OF WATER TEMPERATURE ON FISH.
Food and Agriculture Organization of the United Nations, Rome (Italy). European Inland Fisheries Advisory Commission.
For primary bibliographic entry see Field 05C.
W70-01227

WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH; REPORT ON WATER TEMPERATURE AND INLAND FISHERIES BASED MAINLY ON SLAVONIC LITERATURE.
Food and Agriculture Organization of the United Nations, Rome (Italy). European Inland Fisheries Advisory Commission.
For primary bibliographic entry see Field 05C.
W70-01228

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A. Centers of Competence		
U.S. Geological Survey - Hydrology	W70-00836 -- 00879 00986 -- 01019 01022 -- 01042	99
University of Washington - Water Quality Requirements for Aquatic Organisms	W70-01225 -- 01233	8
University of Florida - Eastern U.S. Water Law	W70-00914 -- 00985 01130 -- 01195 00888, 00891 00895, 00912 00913, 01020 01021	143
Vanderbilt University - Thermal Pollution	W70-00880 -- 00887 01239 -- 01241	11
University of Wisconsin - Eutrophication	W70-01068 -- 01084	17
Bureau of Reclamation - Engineering Works	W70-01090 -- 01129 01218 01236 -- 01238	37
Cornell University - Policy Models for Water Resources Systems	W70-00889, 00890 00892 -- 00894 00896 -- 00907 01085	18
University of Arizona - Arid Lands Water Resources	W70-01196 -- 01216	19
Others:		
Federal Water Pollution Control Administration, (American Society of Civil Engineers)	W70-01043 -- 01067	25
Hawaii Water Resources Research Center	W70-00908	1
Georgia Water Resources Center	W70-00909 -- 00910	2
Idaho Water Resources Research Institute	W70-00911	1
North Dakota Water Resources Research Institute	W70-01086	1
Alaska Institute of Water Resources	W70-01087 -- 01088	2
New Jersey Water Resources Research Institute	W70-01217, 01224	2
Forest Service	W70-01219 -- 01221	3
Corps of Engineers	W70-01222 -- 01223	3
	Total	392

* Note: Numbers not used reduces totals where applicable.

☆U. S. GOVERNMENT PRINTING OFFICE : 1970 392-127/13

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2 WATER CYCLE

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4 WATER QUANTITY MANAGEMENT AND CONTROL

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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 3, NUMBER 4
FEBRUARY 15, 1970

W70-01242 -- W70-01641

Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 4
FEBRUARY 15, 1970

W70-01242 -- W70-01641

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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08 ENGINEERING WORKS
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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

THERMAL NEUTRON SCATTERING MEASUREMENTS IN WATER,
Gulf General Atomic, Inc., San Diego, Calif.
G. M. Borgonovi, J. U. Koppel, and J. A. Young.
Office Saline Water Res and Develop Progr Rep No 449, May 1969. 59 p, 20 fig, 45 ref. Available from the Superintendent of Documents, U S Gov't Printing Office, Washington D C, 20402, for $0.65 per copy. OSW Contract No 14-01-0001-1705.

Descriptors: *Water properties, *Analytical techniques, *Neutron absorption, Ice, Water, Elastic theory, Energy transfer, Momentum equation.
Identifiers: *Neutron scattering, Thermal neutrons.

The status, quantity, and usefulness of presently available inelastic neutron scattering measurements in water have been reviewed. On the basis of this review, it has been found that good knowledge of the neutron scattering from water exists only within a limited range of the variables energy and momentum exchanges. A number of suggestions are given for the best experimental and theoretical approach for studying water by means of inelastic slow-neutron scattering. The suggestions include the analysis of the distributions of scattered neutrons instead of the scattering law for some ranges of energy and momentum transfer and the calculation of the cross section with a method that does not require unnecessary approximations. A detailed theoretical analysis of the dynamics of water has been performed for the diffusive and vibrational modes. That part of the dynamics which pertains to the rotational modes has been correlated to the slow-neutron scattering results and a best estimate for the rotational part of the frequency spectrum has been obtained. (Carstea-USGS)
W70-01296

PROPERTIES OF WATER AND AQUEOUS SOLUTIONS AT HIGH PRESSURES AND TEMPERATURES,
Pennsylvania State Univ., University Park.
C. Wayne Burnham, and H. L. Barnes.
Office Saline Water Res and Develop Progr Rep No 383, 1968. 52 p, 9 fig, 10 ref, 1 append. Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC. 20402 for $0.60 per copy. Grant No 14-01-0001-408 (OSW); G 19190 (NSF).

Descriptors: *Water properties, *Aqueous solutions, Pressure, Temperature, Specific weight, Equations, Volume, Argon, Statistical methods.
Identifiers: *Specific volume (Water), International Skeleton Tables.

The specific volume of water in the temperature range 20 deg - 925 deg C, at pressures up to 8,500 bars has been determined. More than 1,000 of such determinations were made in two interconnected argon-pressurized vessels, one of which was equipped with an internal heater. The raw data, in terms of specific volume as a function of pressure and temperature, were fitted throughout most of the P-T region by a ninth degree polynomial in PV as a function of T and P. The data in the low pressure-high temperature region were fitted better by an eighth degree polynomial in PV as a function of T and 1/P. The overall fit of these equations, which were used to generate tables of specific volume on orthogonal coordinates from 1,000 to 8,900 bars and from 20 deg to 900 deg C, is within 0.1% (one standard deviation). Comparisons reveal very good agreement with the work of Bridgman at high pressures and low temperatures and with the International Skeleton Tables at 1,000 bars and high temperatures. (Carstea-USGS)
W70-01299

NONLINEAR PROBLEMS OF COMPRESSIBLE FLOW,
Akademiya Nauk Armyanskoi SSR, Erevan. Institut Matematiki i Mekhaniki.
A. G. Bagdoev.
Jerusalem. Israel Program for Scientific Translations, 1969. 168 p, 19 fig, 1 tab, 65 ref. Clearinghouse TT 69-55023. Translation of Nekotorye Nelineinye Zadachi o Dvizhenii Szhimaemoi Zhidkosti. Erevan 1967. NASA TTF-560.

Descriptors: *Fluid mechanics, *Flow characteristics, *Waves (Water), *Compressible flow, *Mathematical studies, Flow rates, Dimensional analysis, Pressure, Sound waves, Boundaries (Surfaces), Conductivity, Viscous flow.
Identifiers: USSR, Shock wave hydrodynamics.

This monograph is an analytical study of the motion of a half-space of ideal compressible fluid stimulated by an arbitrary pressure front moving over its surface. Physically such a situation takes place in an explosion on or above the surface of a fluid. It is assumed that the pressure in the air may be considered as in the reflection of a shock wave from a rigid wall. The problem is formulated nonlinearly for the pressure, and an isentropic approximation is used. The linear theory can be greatly improved by using only the linear solution. The monograph contains discussions of the fluid pressure with a wave front moving with constant velocity over the surface, and of the pressure distribution for arbitrary conditions at the boundary of a half-space. (Gabriel-USGS)
W70-01300

NEUTRON INELASTIC SCATTERING STUDIES OF WATER AND IONIC SOLUTIONS,
Union Carbide Corp., Tuxedo, N.Y.
For primary bibliographic entry see Field 03A.
W70-01403

OBSERVATIONS OF NOCTILUCENT CLOUDS.
Vsesoyuznoe Astronomo-Geodezicheskoe Obshchestvo, Moscow (USSR).

Translation of Nablyudeniya serebristykh oblakov, Moscow, Nauka, 1967. NASA Tech Transl No 546, Apr 1969. 153 p, 29 fig, 24 tab, 257 ref.

Descriptors: *Clouds, *Cloud physics, *Water circulation, *Atmospheric physics, *Atmosphere, Ice, Winds, Temperature, Sun, Radiation, Instrumentation, Photometers, Light intensity, Altitude, Statistical methods.
Identifiers: *USSR, Noctilucent clouds.

This monograph on the observations and analytical studies of the noctilucent clouds consists of 14 articles by several USSR investigators. These articles examine the nature and the results of observations of noctilucent clouds floating at the 80-km altitude, wave movements in noctilucent clouds, methods for determining the cloud positions in a projection on the earth's surface, and calculations of the cloud coordinates using electronic computers. Some articles are devoted to linking the appearances of noctilucent clouds with atmospheric currents on the earth and with sunspot activity. (Gabriel-USGS)
W70-01416

STRUCTURE OF 'POLYWATER',
Pennsylvania Univ., Philadelphia. Dept. of Chemistry; and Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.
Jerry Donohue.
Science, Vol 166, No 3908, p 1000-1001, Nov 21, 1969. 2 p, 2 fig.

Descriptors: *Water structure, *Water properties, *Hydrogen bonding, *Structural models, Viscosity, Density, Molecular structure, X-ray analysis, Theoretical analysis.
Identifiers: *Polywater.

A proposed structure for 'polywater' consists of hydrogen-bonded clusters of water molecules lying at the vertices of rhombic dodecahedra. In this model, all O-O bond angles can be very near to the 109 deg 28 min value observed in 8 forms of ice and in numerous hydrates. (Knapp-USGS)
W70-01443

THERMODYNAMIC PROPERTIES OF SEAWATER AND ITS CONCENTRATES,
Monsanto Research Corp., Everett, Mass.
B. M. Fabuss, and A. Korosi.
Desalination 2, 271-78, 1967. 4 fig, 3 ref. Presented at 2nd European Symp Fresh Water from Sea, Vol 2, Athens, May 1967. OSW sponsored.
Identifiers: *Physical properties, *Thermodynamics, Viscosity.

Densities, vapor pressures, and viscosities of binary and ternary solutions were measured at concentrations corresponding to that of seawater and its concentrates up to a fivefold concentration over a 25 to 175 deg C temperature range. The method of investigation was to measure property values on binary solutions containing single salts, and then on ternary solutions. With correlations that were developed, the investigation was extended to multicomponent electrolyte systems. It is believed that density values of similar systems can be estimated with good reliability using this method. The superposition of an Othmer plot of the density of seawater on log-log scale vs density of water, on a plot of salt solution densities, shows that there is excellant agreement between experimental and theoretical data.
W70-01566

SOME PHYSICAL PROPERTIES OF SEA WATER IN VARIOUS CONCENTRATIONS,
National Engineering Laboratory, East Kilbride (Scotland).
W. H. Emerson, and D. T. Jamieson.
Desalination 3, 213-224, 1967, 6 fig, 7 ref. Presented at 2nd European Symp Fresh Water From Sea, Vol 2, Athens, May 1967.
Identifiers: *Physical properties, Experimental data, Research results, Thermal properties.

The vapor pressure of seawater and its concentrates has been measured in the temperature range 100 deg C to 180 deg C using a single isoteniscope, and the thermal conductivity has been determined in the range of zero to 75 deg C by a hot-wire comparative method. Most of the measurements were made with synthetic seawater containing no calcium sulphate, though some results obtained with natural seawater are also given. Concentrations up to five times that of natural seawater were studied. The measured values of vapor pressure have been fitted by an equation which assumes that for a given composition of salts the activity is a pure function of the total ionic strength. This yields a standard deviation as good as that obtained with measurements on distilled water and the NEL steam tables. The smoothed values of thermal conductivity are believed to be accurate to plus or minus 3%. A rise in salinity with increasing temperature is a consequence of migration of water from the liquid to the vapor phase.
W70-01568

PROPERTIES OF SEA WATERS AND ITS CONCENTRATES UP TO 200 DEG C,
California Univ., San Diego, La Jolla.
L. A. Bromley.
OSW R and D Progr Rept No 227, Dec 1966. 54 p, 32 fig, 10 ref.
Identifiers: *Physical properties, *Thermal properties, Thermodynamics, *Thermal capacity.

Heat capacities at one ATM pressure have been measured for seawater solutions over a concentration range of 1.1 to 11.7% salinity and a temperature range of 2 to 80 deg C. The accuracy is about 0.1%. Heat capacities as a function of temperature

are described by parabolic equations which yield values within one part per thousand of the experimental values. Near natural seawater concentration the relationship is linear. A nomograph is given from which heat capacities of sodium chloride solutions and for a synthetic seawater concentrate are compared with those of seawater solutions. Temperature coefficients of the heat capacities are also compared. The development of the design and fabrication of the pressure calorimeter are described.
W70-01572

1B. Aqueous Solutions and Suspensions

HEAT-MASS TRANSFER TO PARTICLES SUSPENDED IN AGITATED LIQUIDS: 1. TRANSPORT BETWEEN LIQUIDS AND SPHERICAL PARTICLES IN A TANK,
Massachusetts Inst. of Tech., Cambridge.
T. K. Sherwood, and P. L. T. Brian.
Office Saline Water Res and Develop Progr Rep No 334, Chapter 1, p 1-24, Apr 1968. 24 p, 5 fig, 27 ref. Available from the Superintendent of Documents, US Gov't, Printing Office, Washington, DC, 20402, for $0.40 per copy. Grant No 14-01-0001-546 (OSW).

Descriptors: *Heat transfer, *Melting, Mass transfer, Convection, Ice, Correlation analysis, Statistical methods, Grivity, Density, Thermodynamics, Mixing, Turbulence.
Identifiers: *Agitated liquid, Ice spheres.

Data are reported for heat transfer from water to melting ice spheres and for mass transfer in the case of dissolving spheres of pivalic acid suspended in water agitated in a stirred vessel. The transport coefficients are found to depend on agitator power input but not on agitator design, in agreement with the Kolmogoroff theory. These experimental results are used with others in the literature to develop a correlation involving Nusselt and Prandtl or Schmidt numbers together with a dimensionless group involving agitation power. The correlation is essentially independent of solid-liquid density ratio in the range 0.8 to 1.25, and in this range the gravity group also appears to be unimportant. (Carstea-USGS)
W70-01297

HEAT-MASS TRANSFER TO PARTICLES SUSPENDED IN AGITATED LIQUIDS: 2. EFFECTS OF TRANSPIRATION AND CHANGING DIAMETER TO SPHERES,
Massachusetts Inst. of Tech., Cambridge.
T. K. Sherwood, and P. L. T. Brian.
Office Saline Water Res and Develop Progr Rep No 334, Chapter 2, p 25-58, Apr 1968. 34 p, 12 fig, 3 tab, 15 ref. Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.40 per copy. Grant No 14-01-0001-546 (OSW).

Descriptors: *Heat transfer, *Melting, *Mass transfer, Convection, Ice, Correlation analysis, Statistical methods, Gravity, Density, Thermodynamics, Mixing, Turbulence.
Identifiers: *Agitated liquid, Viscous flow, Ice spheres.

Mass transfer to spheres suspended in an agitated liquid was studied experimentally and theoretically. Finite-difference solutions are obtained from a sphere to a fluid flowing past it in steady viscous flow. Effects of a transpiration velocity at the surface of the sphere and of a continuously changing sphere diameter are included. A normalized presentation of these effects is quite insensitive to the bulk flow Peclet number. When these theoretical corrections for transpiring and shrinking spheres are applied to the mass transfer data for ice spheres melting in an agitated brine bath, the corrected mass tranfer coefficients are brought into agreement. This aggreement suggests that the theoretical results apply with reasonable accuracy to a shrinking and transpiring sphere suspended in a turbulent liquid. (Lang-USGS)
W70-01298

THERMOPHYSICAL PROPERTIES OF SALINE WATER,
Monsanto Research Corp., Everett, Mass. Boston Labs.
For primary bibliographic entry see Field 03A.
W70-01402

02. WATER CYCLE

2A. General

THE DEFINITION OF THE TERMS HYDROLOGICALLY ARID AND HUMID FOR AUSTRALIA,
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 07A.
W70-01267

MUD FLOW STUDIES (RUSSIAN),
Yu B. Vinogradov, V. V. Golubtsov, G. M. Beruchashvili, T. L. Kirenskoya, and Ye. D. Duseynov.
Trudy Kazakhskogo Nauchno-Issledovatel'skogo Gidrometeorologicheskogo Instituta, No 33, 1969. 167 p, 36 fig, 21 tab, 88 ref, 6 append.

Descriptors: *Mudflows, *Surveys, Streamflow, Mathematical studies, Floods, Soil stability, River basins, Mapping, Velocity, Rivers, Geology, Soil dynamics, Soil properties, Sediments, Glacial soils, Hydraulics.
Identifiers: *USSR, Mudflow hydraulics.

A collection of 16 articles by USSR investigators contains analytical and experimental studies of the mudflow phenomenon. Topics discussed include mudflow formation processes, mudflow protection engineering, mudflow hydraulics, mudflow source area geology, and glacial mudflows. (Gabriel-USGS)
W70-01276

EVOLUTION DES VERSANTS CARTOGRAPHIE GEOMORPHOLOGIQUE DYNAMIQUE FLUVIALE: VOLUME 1, EVOLUTION DES VERSANTS (FRENCH),
For primary bibliographic entry see Field 02J.
W70-01277

PRESENT EVOLUTION OF SLOPES IN THE CARPATHIANS USING FIXED OBSERVATIONS AS AN EXAMPLE (FRENCH),
For primary bibliographic entry see Field 02J.
W70-01278

INITIAL RESULTS OF THE ANALYTIC STUDY OF SURFACE RUNOFF AND EROSION IN THE SAHARA ZONE - KOUNTKOUZOUT BASIN (NIGER) AS AN EXAMPLE (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
For primary bibliographic entry see Field 02E.
W70-01279

RECORDER CHART PROCESSING OF HYDROMETEOROLOGICAL AND HYDROLOGIC DATA AT THE HYDROLOGICAL SECTION OF THE HYDROLOGY SECTION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM (FRENCH),
Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
For primary bibliographic entry see Field 07A.
W70-01284

THE ROLE OF THE EQUILIBRIUM CONCEPT IN THE INTERPRETATION OF LANDFORMS OF FLUVIAL EROSION AND DEPOSITION,
Maryland Univ., College Park.
For primary bibliographic entry see Field 02J.
W70-01288

APPLICATION OF STANFORD WATERSHED MODEL CONCEPTS TO PREDICT FLOOD PEAKS FOR SMALL DRAINAGE AREAS; HPR-1 (3): KYHPR-64-23,
Lexington Dept. of Highways, Ky. Div. of Research.
For primary bibliographic entry see Field 04C.
W70-01293

A PERTURBATION SOLUTION TO UNSTEADY UNCONFINED GROUND WATER FLOW,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W70-01407

OBSERVATIONS OF NOCTILUCENT CLOUDS.
Vsesoyuznoe Astronomo-Geodezicheskoe Obshchestvo, Moscow (USSR).
For primary bibliographic entry see Field 01A.
W70-01416

RECHARGE FROM INDUCED STREAMBED INFILTRATION UNDER VARYING GROUND-WATER LEVEL CONDITIONS,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics; and Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 02G.
W70-01417

SUBSURFACE IMPLICATIONS FROM SURFACE HYDROGRAPH ANALYSIS,
Georgia Inst. of Tech., Atlanta. School of Engineering.
Willard M. Snyder.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 35-45, 1969. 11 p, 6 fig, 1 tab.

Descriptors: *Hydrograph analysis, *Rainfall-runoff relationships, *Computer models, *Computer programs, Digital computers, Data processing, Mathematical models, Hydrologic budget, Rainfall, Antecedent precipitation, Streamflow forecasting.
Identifiers: Computer watershed models.

Computer-based techniques for hydrograph analysis are useful in studying processes by which a watershed receives, stores, conveys, and releases water to form stream discharge. Computer techniques differ from conventional procedure in several respects. The total response of the streamflow to storm input is analyzed. Only flow antecedent to the storm under analysis is separated. The hydrograph is open ended. By this is meant that it is not necessary to specify a time at which flow of a certain category becomes zero. The surface hydrograph is separated into a large number of time-of-flow categories after, and based upon, the storm analysis. Every storm in a watershed record can be treated. It is not necessary to limit so-called unit hydrograph derivation to a few selected storms. The procedures described represent a complete 'package' of computer programs for processing of hydrologic records. The techniques of hydrograph analysis are treated in detail. Each step in the data processing procedures is described briefly so that the hydrograph analysis can be visualized in proper context. (Knapp-USGS)
W70-01421

SUBSURFACE FLOW REGIMES OF A HYDROLOGIC WATERSHED MODEL,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
C. A. Onstad, and D. G. Jamieson.

Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 46-55, 1969. 10 p, 9 fig, 10 ref.

Descriptors: *Rainfall-runoff relationships, *Parametric hydrology, *Mathematical models, *Base flow, Computer models, Computer programs, Demonstration watersheds, Hydrologic budget, Hydrograph analysis, Data processing, Recession curves, Seepage, Groundwater movement, Runoff forecasting, Streamflow forecasting.
Identifiers: Coshocton (Ohio), Watershed models.

The relation of base flow to precipitation events was studied by hydrograph analysis using data from an ARS experimental watershed at Coshocton, Ohio. Models of base flow in watershed systems are reviewed and a new watershed simulation model is proposed. The model presented is an attempt to objectively simulate the various subsurface flow regimes. Despite the necessity of inferring the inputs to the various flow regimes, the model is realistic since it utilizes only the measured response of each flow regime. The purpose of the model is not merely to separate base flow from the total hydrograph but to simulate and later synthesize the land phase of the hydrologic system. Although it possesses thresholds which make the system nonlinear, linear reservoir theory is assumed applicable above the thresholds. The majority of parameters are inserted as measurable quantities. The system is flexible--reservoirs can be added, subtracted, or combined depending upon the response of the particular watershed. The simulation has only been demonstrated at Coshocton, Ohio, and therefore, requires further testing in differing physiographic areas. (Knapp-USGS)
W70-01424

ENERGY DISSIPATION IN A TIDAL ESTUARY,
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 02L.
W70-01430

STUDY OF THE RELATIONSHIP BETWEEN SURFACE AND SUBSURFACE FLOWS IN THE VIDOURLE (GARD) BASIN (FRENCH),
Montpellier Univ. (France). Faculte des Sciences.
Claude Drogue.
Chronique d'Hydrogeologie, No 10, p 49-57, 1967. 6 fig, 6 ref.

Descriptors: *Runoff, *Subsurface flow, *Streamflow, *Karst, Aquifers, Infiltration, Hydraulic properties, Geology, Mapping, Limestones, River basins, Water sources, Discharge (Water), Hydrologic data, Gaging stations, Floods, Storm runoff.
Identifiers: *France, Vidourle (Gard) basin.

This article is a brief study of the water regime of the Vidourle River of Southern France, which passes through both karstic and non-karstic areas. The study based on hydrological and geological data shows that the greatest part of the streamflow in the upper reaches of the river is lost by infiltration into the karstic limestone rocks; however, this lost flow appears in the lower reaches. This water circulation can be explained by high infiltration coefficients and high water loss characterizing the subterranean runoffs. (Gabriel-USGS)
W70-01455

2B. Precipitation

THERMAL RADIATION FROM THE ATMOSPHERE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Sherwood B. Idso, and Ray D. Jackson.
Journal of Geophysical Research, Vol 74, No 23, p 5397-5403, Oct 20, 1969.

Descriptors: *Thermal radiation, *Atmosphere, *Air temperature.

A theoretical analysis of atmospheric thermal radiation was done and revealed that previous formulas relating this parameter to screen-level air temperature have lacked universal applicability. New considerations indicate that the effective emittance of the atmosphere is a minimum at 273 deg K and that it increases symmetrically to approach unity exponentially at higher and lower temperatures. A formula is developed that meets these standards and fits experimental data from Alaska, Arizona, Australia, and the Indian Ocean with a correlation coefficient of 0.992. The atmospheric radiation R, integrated over all wavelengths, is specified solely in terms of the screen-level air temperature T as R= (sigma) (T to the 4th power) (1 - c exp (- d (273 -T)sq)) where c and d are constants having values of 0.261 and 0.000777, respectively. It appears that the formula may be valid at all latitudes and seasons. (Guerrero-Vanderbilt)
W70-01386

EDDY DIFFUSION COEFFICIENTS DUE TO INSTABILITIES IN INTERNAL GRAVITY WAVES,
Southwest Center for Advanced Studies, Dallas, Tex.
R. R. Hodges, Jr.
Journal of Geophysical Research, Space Physics, Vol 74, No 16, p 4087-4090, Aug 1, 1969. 11 ref, 1 fig.

Descriptors: *Diffusion, *Turbulence, *Atmosphere, Heat transfer.
Identifiers: *Internal gravity waves, *Eddy diffusion coefficient, Mesosphere, Thermosphere.

The purpose of this study was to elucidate the role that internal gravity waves play in the generation of turbulence in the mesosphere and lower thermosphere. Internal gravity waves in the upper atmosphere tend to grow in amplitude with increasing height to maintain continuous vertical transport of wave energy. The growth of amplitude of a wave is limited by convective instabilities that must form at the height where the temperature oscillation becomes great enough to include a superadiabatic region. This turbulence attenuates the wave by eddy transport of heat and viscous stress through the wave structure, essentially maintaining a constant amplitude of the wave at greater altitudes. An eddy diffusion coefficient of the order of 10 to the 7th power cm sq/ sec is sufficient to explain the thermal structure of the mesopause region. Sporadic turbulence produced by instabilities in gravity waves is probably an important process of the upper atmosphere. Conclusions were (a) Internal gravity waves are an important source of turbulence in the upper atmosphere. (b) Wave-induced turbulence is the dominant cause of eddy transport throughout the mesosphere and lower thermosphere. (Guerrero-Vanderbilt)
W70-01388

METEOROLOGICAL APPLICATIONS OF REFLECTED RADIANCE MEASUREMENTS FROM ATS 1 AND ATS 3,
Wisconsin Univ., Madison. Space Science and Engineering Center.
For primary bibliographic entry see Field 07B.
W70-01436

CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION IN SOME REGIONS OF THE USSR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-01448

SELECTED BIBLIOGRAPHY ON THE CLIMATE OF THE CENTRAL AMERICAN COUNTRIES,
Environmental Technical Applications Center (Air Force), Washington, D.C.
For primary bibliographic entry see Field 10.
W70-01476

THE SNOW COVER OF THE ANTARCTIC AND ITS ROLE IN THE PRESENT-DAY GLACIATION OF THE CONTINENT,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
For primary bibliographic entry see Field 02C.
W70-01477

2C. Snow, Ice, and Frost

TILL FABRIC ANALYSES FROM THE LOTHIANS, CENTRAL SCOTLAND,
Edinburgh Univ. (Scotland). Dept. of Geography.
R. P. Kirby.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 48-60, 1969. 13 p, 8 fig, 1 tab, 37 ref.

Descriptors: *Till, *Petrofabrics, *Analytical techniques, *Pleistocene epoch, Glaciers, Mapping, Geology, Topography, Glacial drift, Altitude, Data collections, Data processing, Statistical methods, River basins.
Identifiers: *Central Scotland, Lothian till.

The results of 64 till fabric analyses taken from three superposed tills of Central Scotland are described in detail. Highland ice moved across the Lothians from W to E. Over some parts of the district, the basal till is covered by the intermediate till whose regional fabric pattern indicates Southern Uplands ice-movement from SW to NE. The uppermost layers of till, the Roslin till, however represent a minor readvance from the north. (Gabriel-USGS)
W70-01254

STUDIES OF THE INTERNAL DRAINAGE OF GLACIERS,
Uppsala Univ. (Sweden). Dept. of Physical Geography.
Thorsten Stenborg.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 13-41, 1969. 29 p, 16 fig, 46 ref.

Descriptors: *Glaciers, *Drainage systems, *Drainage patterns (Geologic), *Tracers, Tracking techniques, Fissures (Geology), Streamflow, Model studies, Topography, Geomorphology, Mapping, Snowmelt, Seismic studies, Hydrologic properties, Ablation, Permafrost.
Identifiers: *Sweden, Mikka and Stor glaciers.

Internal drainage of Mikkaglaciaren and Storglaciaren of Northern Sweden was investigated on the basis of salt injections and seismic and hydrogeological data. The internal drainage of Mikka glacier consists of two separate systems corresponding on the surface of the glacier to areas of fissures characterized by different strike directions. A drainage model devised for Mikka glacier is assumed to be applicable to the drainage of Stor glacier. (Gabriel-USGS)
W70-01255

A TYPE OF CIRCULAR LAKES IN NORTHERNMOST NORWAY,
Lund Univ. (Sweden). Dept. of Physical Geography.
For primary bibliographic entry see Field 02H.
W70-01256

WATER SUPPLY IN COLD REGIONS,
Army Terrestrial Sciences Center, Hanover, N.H.
Amos J. Alter.
Available from Clearinghouse as AD 685 850, for $3.00 in paper copy, $0.65 in microfiche. Cold Reg Sci and Eng Monogr 3, Sec C5a, Jan 1969. 85 p, 62 fig, 8 tab, 228 ref, 1 append. DA Proj 1T062112A130.

Descriptors: *Water supply, *Waste disposal, *Sanitary engineering, *Cold regions, Water treatment, Sewage treatment, Cold weather construction, Permafrost, Tundra.
Identifiers: Cold region sanitary engineering.

The principles involved in cold-region sanitary engineering are not materially different from those of sanitary engineering in temperate climates, but application of these principles is different. Heat conservation, humidity, light, construction and operation costs, and the efficient use of materials and resources are more important in cold regions; biological and chemical reactions are generally retarded at low temperature; and materials and their physical characteristics must be evaluated under cold-region conditions. Thermal analysis of all materials, systems and processes must be included as a part of the design; neglect of this may result in project failure. Availability and use of heat energy are highly important in sanitary engineering systems in cold regions. Water and fuel oil may be comparable in value, and new limits are imposed on design. Unavailability of aggregates, timber and many other common building materials from local sources limits construction. Among the approaches to solving the cold regions water system problems have been (1) encapsulation of the water system, (2) warming of the whole environment, and (3) substitution of a 'bucket brigade' consept for a proper community distribution system. A cold-region community spread over a large area cannot be effectively supplied with water from a conventional central system with long distribution lines. (Knapp-USGS)
W70-01259

WATER TEMPERATURES IN A SHALLOW LAKE DURING ICE FORMATION, GROWTH AND DECAY,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02H.
W70-01393

PILOT STUDY OF ICE DRIFT IN THE GULF OF ST. LAWRENCE,
Massachusetts Inst. of Tech., Cambridge; McGill Univ., Montreal (Quebec). Marine Sciences Centre; and McGill Univ., Montreal (Quebec). Dept. of Physics.
R. G. Ingram, O. M. Johannessen, and E. R. Pounder.
J Geophys Res, Vol 74, No 23, p 5453-5459, Oct 20, 1969. 7 p, 3 fig, 1 tab, 7 ref.

Descriptors: *Ice, *Drifting (Aquatic), *St. Lawrence River, *Remote sensing, *Instrumentation, Buoys, Wind pressure, Theoretical analysis, Mathematical studies, Currents (Water), Air Meteorology, Seasonal, Latitudinal studies, Tidal effects.
Identifiers: Gulf of St. Lawrence, Ice drift.

A pilot study of ice drift has been made in the Gulf of St. Lawrence. A toroidal buoy with a radio beacon that was set out March 1, 1967, on an ice floe off the Gaspe coast drifted toward the southeast. Seven position determinations were made by the Ice Reconnaissance Aircraft, Meteorological Branch, up to March 20, when the beacon stopped transmitting. The buoy was recovered on May 7 south of the Magdalen Islands. By means of the Reed and Campbell theory, the ice drift due to the wind stress is calculated and the difference between the theoretical drift and the observed drift is assumed to result from surface current. The area between Anticosti Island and the Gaspe coast shows great variability with regard to its surface circulation, as during ice-free months. Furthermore, the analysis indicates that the internal ice stress, which is neglected in the Reed and Campbell theory, should be taken into account in future models. Hourly values of the ice drift velocity indicate that the ice floe is affected by the tidal current. (Gabriel-USGS)
W70-01446

THE SNOW COVER OF THE ANTARCTIC AND ITS ROLE IN THE PRESENT-DAY GLACIATION OF THE CONTINENT,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
V. M. Kotlyakov.
Isreal Program for Scientific Translations, Jerusalem. 1966. Transl from Izdatel'stvo Akad Nauk SSSR, Moscow, 1961. 256 p, 75 fig, 33 tab, 413 ref. Clearinghouse TT 65-50144.

Descriptors: *Snow cover, *Antarctic, *Glaciation, Climatology, Meteorology, Snow surveys, Ice, Sublimation, Research and development, Winds, Temperature, Glaciers, Firn.
Identifiers: *Antarctic snow cover, Katabatic winds, Antarctic ice sheet, Snow-firn layer.

Investigations of the Antarctic snow cover by the USSR in the International Geophysical Year include: (1) climatic and meteorological factors determining the formation of the snow cover; (2) formation of the snow cover; (3) development of the snow-firn cover; (4) some properties of Antarctic snow; (5) peculiarities of the snow cover in different regions of the continent; and (6) evolution and development tendencies of the Antarctic ice sheet. There are 413 references cited in the text. The main characteristics of the formation and development of the Antarctic snow cover have been clarified as a result of half a century of investigation. The formation and development of the snow cover as large ice sheets are determined by the katabatic winds which exist everywhere. The basic processes of ice and firn formation in the Antarctic ice sheet are recrystallization by sublimation and subsidence. The intensity of these processes is primarily a function of temperature of the snow firn layer. Many glaciological problems are solved by studies of the snow-firn cover on glaciers. (Carstea-USGS)
W70-01477

2D. Evaporation and Transpiration

A NOTE ON THE EVAPOTRANSPIRATION FROM A PADDY FIELD,
Kochi Univ. (Japan).
Tokuro Seo, and Nobuyuki Yamaguchi.
Berichte des Ohara Inst fur Landwirtschaftliche Biol, Okayama Univ, Band 14, Heft 3, p 133-143, Nov 1968. 11 p, 3 fig, 2 tab, 10 ref, 2 append.

Descriptors: *Evapotranspiration, *Crops, Micrometeorology, Seasonal, Microenvironment, Heat balance, Dynamics, Land use, Rice, Irrigation water, Plants, Mathematical studies, Soil temperature, Radiation, Winds, Altitude, Roughness coefficient, Water loss, Moisture content.
Identifiers: *Japan, Kurashiki, Rice paddies.

Evapotranspiration from a paddy field at Kurashiki, Japan was analyzed for several days during the period July to October 1963 by using heat balance and aerodynamic methods. Using the heat balance method, determination of the net radiation is reliable to 5 to 10% and evaluation of thermal exchange is rather difficult. The aerodynamic method is based on determination of moisture gradients and wind speed gradients. In general, the heat balance method, although it is less satisfactory theoretically since it includes non-meteorological parameters, can be considered as more suitable for evapotranspiration studies of rice fields. (Gabriel-USGS)
W70-01287

2E. Streamflow and Runoff

BRAHMAPUTRA RIVER: CHANNEL PROCESSES AND SEDIMENTATION,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W70-01242

ON THE GEOMETRY OF CURRENT RIPPLES IN RELATION TO STABILITY OF FLUID FLOW,
Reading Univ. (England). Sedimentology Research Lab.
J. R. L. Allen.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 61-96, 1969. 36 p, 36 fig, 8 tab, 84 ref.

Descriptors: *Ripple marks, *Analytical techniques, *Currents (Water), *Streamflow, Friction, Topography, Model studies, Geology, Sands, Wavelengths, Waves (Water), Mathematical studies, Correlation analysis, Fluid mechanics, Fluid friction, Froude number, Vortices, Hydraulic models.
Identifiers: *Current-ripple geometry, Fluid flow stability.

The relation of geometry of small-scale current ripples to the evolved flow over the bed was investigated analytically and experimentally by assuming fluid stability. Wave-like changes of current-ripple elevations are associated with adjustment of the streambed to three-dimensional fluid motion and are characterized by corkscrew vortices similar to the Taylor-Gorter vortex type. Experiments made with beds of a fine-grained quartz sand reveal that the characteristic wavelength of features due to vortices diminishes with increasing relative roughness and Froude number. An empirical equation connecting the mean wavelengths of spanwise and streamwise features of a rippled bed, with the relative roughness and Froude number, appears to be applicable to the study of much larger dunes formed in water. Wavelength ratios for these dunes overlap in value with ratios measured from subaqueous bed forms. (Gabriel-USGS)
W70-01243

WATER SUPPLIES FOR COULEE DAM NATIONAL RECREATION AREA, WASHINGTON,
Geological Survey, Tacoma, Wash.
Henry W. Anderson, Jr.
Geol Surv Open-file Rep, 1969. 104 p, 32 fig, 16 tab, 16 ref.

Descriptors: *Water resources, *Water demand, *Recreation, Facilities, *Washington, *Grand Coulee Dam, Groundwater, Aquifers, Water wells, Water quality, Water yield, Glacial drift, Streamflow.
Identifiers: Coulee Dam National Recreation Area.

A general evaluation was made of the overall water resources of the Coulee Dam recreation area, Washington and potential water supplies were located and described in detail at several campgrounds where expansion of facilities is anticipated. Although surface water is available from streams at several campgrounds and from Franklin D. Roosevelt Lake, the treatment required of surface-water supplies makes groundwater a preferred source. Most groundwater in Coulee Dam National Recreation Area is available from unconsolidated deposits that formed glacial-lake deltas and glacial outwash in Pleistocene time. Groundwater may possibly be available from the bedrock which includes basalt of the Columbia River Group of Miocene-Pliocene age in the southern part of the area, and the northern part of the area. The project included an evaluation of the water-supply potential at 35 campgrounds and picnic areas. Groundwater supplies were obtained by production wells drilled at 4 sites. Groundwater could be obtained at each of 8 other campgrounds where a detailed study was made, and supplies could be obtained at most of the other 23 campgrounds in the project area. The chemical quality of groundwater in most of the area is good. (Knapp-USGS)
W70-01244

COMBINED USE OF SURFACE AND GROUND WATER FOR THE WATER SUPPLY TO BARCELONA (SPAIN),
For primary bibliographic entry see Field 04B.
W70-01248

FLOOD PLAIN INFORMATION, GLACIER CREEK, GIRDWOOD, ALASKA.
Army Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 04A.
W70-01249

TEMPERATURE OF SURFACE WATERS IN MONTANA,
Geological Survey, Helena, Mont.
For primary bibliographic entry see Field 07C.
W70-01250

FLOOD PLAIN INFORMATION, KAAAWA, OAHU, HAWAII.
Corps of Engineers, Honolulu, Hawaii.
For primary bibliographic entry see Field 04A.
W70-01251

FLOOD PLAIN INFORMATION, MORGANTON, NORTH CAROLINA: VOLUME 1. HUNTING CREEK AND TRIBUTARIES.
Corps of Engineers, Charleston, S.C.
For primary bibliographic entry see Field 04A.
W70-01252

INITIAL RESULTS OF THE ANALYTIC STUDY OF SURFACE RUNOFF AND EROSION IN THE SAHARA ZONE - KOUNTKOUZOUT BASIN (NIGER) AS AN EXAMPLE (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
G. Vuillaume.
Cahiers ORSTOM, Ser Hydrol, Vol 5, No 2, p 33-56, 1968. 5 fig, 2 tab, 5 ref.

Descriptors: *Surface runoff, *Erosion, *River basins, Agriculture, Economics, Population, Storms, Geology, Tertiary period, Vegetation, Humus, Soils, Gaging stations, Discharge measurement, Suspended load, Sedimentation, Floods, Pit recharge.
Identifiers: *Niger Basin.

Hydrological and erosional data were recorded in the Kountkouzout (Niger) Basin for the purpose of protecting agricultural land from floods and soil erosion. The verification of water discharge, erosion measurement techniques, results of solid transport, and erosion balance are discussed. The results of the study are given in numerous tables and figures showing the values of runoff, erosion, saturation, precipitation, solid load transport, and suspension recorded during the dry and wet seasons of 1965, 1966 and 1967. (Gabriel-USGS)
W70-01279

ON THE PENETRATION OF A TURBULENT LAYER INTO STRATIFIED FLUID,
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
For primary bibliographic entry see Field 08B.
W70-01383

JET DIFFUSION IN THE REGION OF FLOW ESTABLISHMENT,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 08B.
W70-01387

AN EXPERIMENTAL STUDY OF TURBULENCE IN A DENSITY-STRATIFIED SHEAR FLOW,
Manchester Univ. (England). Dept. of the Mechanics of Fluids.
For primary bibliographic entry see Field 08B.
W70-01389

TIME-OF-TRAVEL STUDY - MOHAWK RIVER, ROME, NEW YORK TO COHOES, NEW YORK,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 05B.
W70-01404

RIP CURRENTS: 1. THEORETICAL INVESTIGATIONS,
Liverpool Univ. (England). Tidal Inst.
Anthony J. Bowen.
J Geophys Res, Vol 74, No 23, p 5467-5478, Oct 20, 1969. 12 p, 7 fig, 25 ref.

Descriptors: *Rip currents, *Mathematical studies, *Theoretical analysis, *Vortices, Water circulation, Coasts, Waves (Water), Frequency analysis, Flow characteristics, Beaches, Shallow water, Barriers.
Identifiers: *Vorticity, Rip current formation.

The nearshore circulation of water on a plane beach produced by a wave train, normally incident on the beach, which has a longshore variation in wave height is investigated theoretically. The radiation stress arising from the excess flux of momentum due to the presence of the waves is found to provide driving terms for a steady flow pattern only inside the surf zone. A circulation pattern is thus produced by a longshore variation in the radiation stress in the surf zone. In shallow water, the radiation stress is proportional to the square of the wave height. The nearshore circulation is therefore directly related to longshore variation in breaker height, currents flowing seaward where the breaker height is low. When the inertial terms are included in the vorticity equation, an increase in the effective Reynolds number produces a narrowing, and consequently a strengthening, of the seaward flow, which suggests an explanation for the existence of the strong, narrow currents known as rip currents. (Gabriel-USGS)
W70-01431

2F. Groundwater

WATER SUPPLIES FOR COULEE DAM NATIONAL RECREATION AREA, WASHINGTON,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02E.
W70-01244

COMBINED USE OF SURFACE AND GROUND WATER FOR THE WATER SUPPLY TO BARCELONA (SPAIN),
For primary bibliographic entry see Field 04B.
W70-01248

SOLVING MULTI-WELL, RIVER GROUND WATER FLOW PROBLEMS,
Birmingham Univ. (England). Dept. of Civil Engineering.
Robin Herbert.
J Hydrol, Vol 9, No 2, p 213-221, Oct 1969. 9 p, 8 fig, 2 tab, 5 ref.

Descriptors: *Groundwater movement, *Mathematical studies, *Model studies, *Surface-groundwater relationships, Induced infiltration, Hydraulic models, Analog models, Flow nets.
Identifiers: Hydrologic models.

A technique is described which enables three-dimensional groundwater flow between canals and multi-well systems to be reduced to two dimensions. Using the technique, two solutions are obtained to wells pumping near a partially penetrating river. The results are shown to be accurate by comparing them to full three-dimensional solutions. (Knapp-USGS)
W70-01263

INTERFLOW OR SHALLOW PHREATIC FLOW IN THE COASTAL PLAIN OF GEORGIA,
Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center, and Georgia Agricultural Experiment Station, Athens.
For primary bibliographic entry see Field 02G.
W70-01266

THE USE OF TRACERS TO INVESTIGATE THE RELATIONSHIP BETWEEN MINING SUBSIDENCE AND GROUNDWATER OCCURRENCE AT ABERFAN, SOUTH WALES,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology; and National Coal Board, Ystrad Mynach (Wales).
J. D. Mather, D. A. Gray, and D. G. Jenkins.
J Hydrol, Vol 9, No 2, p 136-154, Oct 1969. 19 p, 6 fig, 5 tab, 12 ref.

Descriptors: *Landslides, *Groundwater movement, *Subsidence, *Mine wastes, *Waste dump, Mine drainage, Coal mine wastes, Disasters, Tracers, Tracking techniques, Ions, Solutes, Dye releases, Permeability, Hydrogeology.
Identifiers: *Wales, *Aberfan.

Four groundwater tracing experiments, using sodium chloride and sodium fluorescein as tracers, were undertaken at Aberfan, Wales in order to investigate the influence of mining subsidence on the pattern of groundwater flow. Measurements indicated that areas subject to tensional strains were characterized by rapid groundwater movement and areas subject to compressional strains by slow or negligible groundwater movement. Boundaries between zones of tensile and compressional strains should be regarded as potential hydraulic discontinuities. Mining subsidence appeared to have contributed to the enlargement of the groundwater catchment draining the tip-complex at Aberfan. (Knapp-USGS)
W70-01268

DETERMINATION OF WATER SATURATION HEIGHT (FRENCH),
Strasbourg Univ. (France). Geologic Maps Service of Alsace and Lorraine.
L. Simler, and P. Ungemach.
Strasbourg Univ, Serv Carte Geol D'Alsace et Lorraine, Note de Calcul No 2, June 15, 1968. 17 p.

Descriptors: *Aquifers, *Saturation, *Saturated flow, *Permeability, *Mathematical models, Mathematical studies, Free surfaces, Runoff, Infiltration, Discharge (Water), Humidity, Air temperature, Evaporation, Diffusivity.
Identifiers: Aquifer saturation.

Water-saturation levels were analytically investigated by applying partial differential equations, the Carson-Laplace transformation formula, and Fourier Series. Somewhat similar analytical approaches were used for watertight and semipermeable basements. The vertical permeability of the basement can be evaluated provided the aquifer thicknesses and some other parameters are known. (Gabriel-USGS)
W70-01274

BASIC RESULTS OF HYDROGEOLOGIC INVESTIGATIONS OF OIL-BEARING REGIONS OF THE NORTHWESTERN SIBERIA (RUSSIAN),
Ministerstvo Geologii, Moscow (USSR).
O. V. Ravdonikas.
Trudy Nauchno-Issledovatel'skogo Instituta Geologii Arktiki, Vol 129, 1962. 194 p, 23 fig, 31 tab, 73 ref, append.

Descriptors: *Oil fields, *Hydrogeology, *Hydrologic properties, *Hydraulic properties, Oil reservoirs, Boreholes, Geology, Geophysics, Groundwater, Water pressure, Water temperature, Mechanical equipment, Instrumentation, Water chemistry, Natural gas, Permafrost.
Identifiers: *USSR, West Siberian oil fields, Oil field hydrogeology.

This monograph is a detailed description of analytical and field methods and techniques necessary in carrying out a reliable hydrogeological exploration for the location of natural gas and oil structures and in forecasting gas and oil possibilities. The greatest part of the monograph, however, comprises the description and the analysis of the results obtained in the northwestern part of Siberia in exploration for oil and gas reservoirs. The monograph contains the following chapters: (1) introduction; (2) investigation methods; (3) hydrogeologic characteristics of the lower reaches of the Yeninsei River; (4) a critical review of borehole data from the Ust'-Port area; (5) groundwaters; (6) conditions affecting the formation of groundwaters; and (7) oil possibilities on the basis of derived hydrogeologic concepts. (Gabriel-USGS)

W70-01275

ON THE POSSIBILITY OF GROUNDWATER AGE DETERMINATION USING TRITIUM-HELIUM-3 METHOD (RUSSIAN),
I. N. Tolstikhin, and I. L. Kamenskiy.
Geokhimiya, No 8, p 1027-1029, Aug 1969. 7 ref.

Descriptors: *Groundwater, *Radioactive dating, *Tritium, *Helium, Meteoric water, Rocks, Aquifers, Streamflow, Radiochemical analysis, Precipitation (Atmospheric), Atmosphere, Porosity.
Identifiers: *Groundwater age determination, Tritium-Helium method.

This brief article gives the pertinent formulas and discusses the procedure for application of Tritium-Helium method for groundwater age determination. The use of the method is based on the assumption that the isotopes of tritium and helium are conserved in the groundwater under investigation. Considerable error occurs when groundwater of relatively young age is mixed with ancient groundwater during its migration underground. In general, age determination using the tritium-helium method can be successful if the addition of radiogenic He-3 is commensurable with or exceeds the atmospheric helium content. (Gabriel-USGS)
W70-01282

WATER-BEARING FISSURES OF THE CEVENOLE GNEISS BASED ON THE RECONNAISSANCE STUDY OF THE SAINT-JEAN-DU-GARD DAM SITE, FRANCE (FRENCH),
Montpellier Univ. (France). Faculte des Sciences.
Par J. Avias.
La Houille Blanche, No 1, p 47-60, 1967. 5 fig, 1 tab, 6 ref.

Descriptors: *Aquifers, *Fissures (Geology), *Igneous rocks, *Damsites, Mapping, Porosity, Permeability, Water storage, Water loss, Petrography, Geology, Density, Structural geology, Drainage water, Erosion, Mathematical studies, Water circulation, Infiltration, Mechanical properties.
Identifiers: Saint-Jean-Du-Gard (France).

Water-bearing fissures of fractured gneiss were investigated using geological, hydrologic, and borehole data recorded at the Saint-Jean-Du-Gard damsite. The recorded data reveal the geometry and distribution of the fissures and altered zones of thickness varying from 35 to 40 m, with their base parallel to the topographical relief caused by Quaternary sinking. The study indicates the possibility of using drainage tunnels and galleries to increase water yield. (Gabriel-USGS)
W70-01283

MATHEMATICAL METHOD (ABAQUE) PERMITTING RAPID EVALUATION OF AQUIFER TRANSMISSIVITIES (FRENCH),
Montpellier Univ. (France). Faculty de Sciences.
R. Plegat.
Bull Int Ass Sci Hydrol, Vol 12, No 4, p 82-85, Dec 1967. 4 p, 1 fig, 1 tab.

Descriptors: *Groundwater movement, *Mathematical studies, *Aquifers, *Transmissivity, Discharge (Water), Theis equation, Dupuit-Forchheimer theory, Pumping, Water wells, Water storage, Water levels, Water level fluctuations, Drainage (Water), Infiltration.
Identifiers: Aquifer transmissivity evaluation, Aquifer testing.

Because recorded aquifer discharge data often permit only very sketchy transmissivity evaluations, a mathematical method is given to evaluate transmissivities. This method is based on the utilization of the Theis and Jacob formulas, using the aquifer storage coefficient, the pumping well discharge, the pumping duration, and the pumping well distance. Although this rapid method cannot replace the normal methods used for transmissivity evaluations, nevertheless, in case of the paucity of data or for obtaining rough transmissivity values, the method can give satisfactory results. (Gabriel-USGS)
W70-01290

A PERTURBATION SOLUTION TO UNSTEADY UNCONFINED GROUND WATER FLOW,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
Donald Dean Adrian, and Kuang-Mei Lo.
Pap presented at 50th Annu Meeting of Amer Geophys Union, Wash, DC, Apr 21-25, 1969. 22 p, 6 fig, 2 tab, 6 ref. FWPCA Grant No WP-01239-02.

Descriptors: *Unsteady flow, *Aquifers, Base flow, Mathematical models, Equations, Canals, Groundwater movement, Boundary processes.
Identifiers: *Perburbation solution, Partial differential equation, Unsteady unconfined flow.

Unsteady unconfined groundwater flow has been intractable to analytical solutions of the governing nonlinear partial differential equation. Approximation methods for linearizing the governing partial differential equation have been available in the literature; however, the resulting linearized system may not approximate closely the natural groundwater flow, especially near boundaries. The use of perturbation methods is proposed to solve the governing nonlinear partial differential equation for unsteady unconfined flow toward a canal. Finite difference methods and solutions to the linearized partial differential equation have been used to develop independent groundwater profiles to compare with those predicted by the perturbation solution. The perturbation solution appears useful in evaluating aquifer characteristics from drawdown tests. (Carstea-USGS)
W70-01407

TRANSIENT RADIAL FLOW IN UNSATURATED SOIL,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering; and North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W70-01408

THE EFFECT OF SEEPAGE LOSSES ON STREAM REGIMEN,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 04B.
W70-01419

STUDY OF THE RELATIONSHIP BETWEEN SURFACE AND SUBSURFACE FLOWS IN THE VIDOURLE (GARD) BASIN (FRENCH),
Montpellier Univ. (France). Faculte des Sciences.
For primary bibliographic entry see Field 02A.
W70-01455

DETERMINING PERENNIAL RECHARGE,
Geological Survey, Washington, D.C.
Harold E. Thomas.
In: Groundwater Development in Arid Basins - Symposium, Utah State University, 1967, Proceedings. Utah State University, Logan, p 15-20, 1967. 6 p, 8 ref.

Descriptors: *Groundwater recharge, *Water table, *Utah, Water rights, Appropriation, Great Salt Lake, Aquifers, Irrigated land, Groundwater mining, Safe yield, Groundwater basins, Artesian wells, Seepage, Arid lands, Drawdown, Consumptive use.

The author draws from more than 30 years experience in studying several arid groundwater basins in Utah to determine recharge rates. The rate of recharge was commonly determined by using the equation: recharge equals total discharge plus or minus changes in storage. If a basin is to remain productive over the long-term, then consumptive use must be limited to 'safe yield' or average perennial recharge. Otherwise the aquifer will be 'mined' and the water table will continue to fall. Study areas discussed are Cedar City, Parowan, Escalante Valley, and the East Shore of Great Salt Lake. In the Escalante basin there is little recharge and the water level has declined since 1950, averaging less than 2 feet per year. The East Shore area shows recharge from all sources of about 70,000 acre ft/year of which about 40,000 is estimated to move westward and to be lost to evaporation or to go into the Lake. There seems to be a good case for further development. However, such additional use might lower existing artesian pressure in wells and raise a legal question of interference with existing rights. (Crouse-Arizona)
W70-01484

2G. Water in Soils

FLOW AND RETENTION OF WATER IN LAYERED SOILS,
Agricultural Research Service, Washington, D.C.
D. E. Miller.
Agr Res Serv Conserv Res Rep No 13, May 1969. 28 p, 18 fig, 12 tab, 11 ref.

Descriptors: *Soil water movement, *Water storage, *Soils, *Stratification, Permeability, Anistropy, Unsaturated flow, Field capacity, Sands, Clays, Infiltration, Particle size, Moisture content, Hydraulic conductivity.
Identifiers: Stratified soils.

Many irrigated areas are on highly stratified soils, including those with coarse layers in the profile. The water retained by a soil is affected by the characteristics of the entire wetted part of the profile. Soil overlying sand or gravel contains about 6% more water than soil not so underlain. A silt loam soil underlain by sand drains to a water content of about 40% by volume as compared to a 1/3-bar value of 27% by volume. Field water-holding capacities of fine sandy loam soils underlain by coarser materials are 50 to 60% greater than 1/3-bar values. The effect of coarse layers in the profile on soil water-holding characteristics must be understood if in such soils irrigation is to be managed properly. Research data showing the effect of coarse layers on water retention are summarized and ways of estimating water-retention properties of layered soils are discussed. (Knapp-USGS)
W70-01258

THE CALCULATION OF NON-PARALLELISM OF GAMMA ACCESS TUBES, USING SOIL SAMPLING DATA,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 07B.
W70-01262

SOIL MOISTURE MEASUREMENT BY THE GAMMA TRANSMISSION METHOD,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 07B.
W70-01265

INTERFLOW OR SHALLOW PHREATIC FLOW IN THE COASTAL PLAIN OF GEORGIA,
Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center, and Georgia Agricultural Experiment Station, Athens.
Loris E. Asmussen, and J. C. Ritchie.
J Hydrol, Vol 9, No 2, p 182-193, Oct 1969. 12 p, 10 fig, 2 tab.

Descriptors: *Groundwater movement, *Soil water movement, Infiltration, Recharge, Aquifers, Water table, Water balance, Georgia, Coastal plains, Aquicludes, Water measurement, Nuclear moisture meters.
Identifiers: Interflow.

e shallow groundwater flow from a Tifton sandy
m soil in Georgia was evaluated by means of
undwater wells, neutron soil moisture deter-
nations, and water discharge from a gravel-
cked tile drain. The study period was from
nuary 1, 1968, through March 31, 1968. Shallow
w accounted for 1.80 inches of the 5.70 inches
rain received during the period. A water balance
r the period was determined. (Knapp-USGS)
70-01266

OIL SEALING CHEMICALS AND ECHNIQUES,
amond Shamrock Corp., Painesville, Ohio. T. R.
ans Research Center.
r primary bibliographic entry see Field 05E.
70-01273

RACTICAL UTILIZATION OF A NEUTRON OIL-MOISTURE METER FOR HYDROLOGIC EASUREMENTS: INITIAL RESULTS OB-AINED FROM AN INCLINED BASIN OF AFAINA, REPUBLIC OF MADAGASCAR RENCH),
fice de la Recherche Scientifique et Technique
utre-Mer, Paris (France).
erre Pourrut.
hiers ORSTOM, Ser Hydrol, Vol 5, No 2, p 15-
, 1968. 12 fig, 2 tab.

escriptors: *Soil moisture meters, *Nuclear
oisture meters, *Hydrologic properties, *Water
lance, Soils, Radioisotopes, Gravels, Geology,
oisture content, Slopes, Water levels, Storm ru-
ff, Surface runoff, Evapotranspiration, Infiltra-
n, Velocity.
entifiers: Neutron soil moisture meters,
adagascar.

neutron meter was used to analyze the hydrologi-
l characteristics of soil in the Madagascar
epublic during 1966-1967. The discussion in-
udes: (1) mode of operation; (2) initial results
btained from a sloping basin of Tafaina. The
ecessary equipment, the evolution of a hydraulic
rofile, rainstorm runoff, the effect of moisture on
rface runoff, the effect of evapotranspiration, soil
ater penetration, and infiltration velocity are
escribed. The neutron soil moisture meter can be
nsidered as a reliable tool for the evaluation of
il hydrologic profiles. (Gabriel-USGS)
70-01280

IELD MEASUREMENT AND USE OF SOIL-ATER PROPERTIES,
klahoma State Univ., Stillwater. Dept. of Agrono-
y; and California Univ., Davis. Dept. of Water
ience and Engineering.
M. Davidson, L. R. Stone, D. R. Nielson, and M.
LaRue.
ap No H-43, presented at 50th Annu Meeting of
mer Geophys Union, Wash, DC, Apr 21-25,
969. 33 p, 16 fig, 4 tab, 15 ref.

escriptors: *Soil water movement, *Water pro-
erties, Soil profiles, Hydraulic conductivity, Soil
xture, Soil types, Drainage effects, Drainage,
ysteresis, Darcy's law.
entifiers: *Field measurement, Silty clay, Loamy
nd.

hree soil profiles were used for measuring the
lationships between the hydraulic conductivity
nd soil-water content. The physical properties of
ils varied from homogeneous to heterogeneous
nd the surface texture ranged from loamy sand to
lty clay. No measurable hysteresis was shown
om the hydraulic conductivity values which were
alculated from the drainage data. The Darcy's
quation and other assumptions were used to pre-
ict the rate at which water drained from each soil
rofile. (Carstea-USGS)
70-01406

TRANSIENT RADIAL FLOW IN UNSATURATED SOIL,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering; and North Carolina State Univ., Raleigh. Dept. of Soil Science.
Sun-Fu Shih, and George J. Kriz.
Pap No H-87 presented at 50th Annu Meeting of Amer Geophys Union, Wash, DC, Apr 21-25, 1969. 18 p, 4 fig, 14 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Soil water, Pipes, Equations, Continuity equation, Gravity, Diffusivity, Mathematical studies.
Identifiers: *Transient radial flow.

A mathematical solution of a problem of unsaturated transient radial flow in a homogeneous soil surrounding a long infinitely permeable pipe that contains water flowing under pressure was developed. The equation that described the problem combined Darcy's law and the equation of continuity into an appropriate radial flow equation that included the influence of gravity. The flow was assumed symmetrical with respect to the vertical axis. It was also assumed that no flow took place beyond a certain radial distance from the pipe. Using a mean value for the soil water diffusivity, the results showed that the effect of the gravity term decreased with increasing time. (Carstea-USGS)
W70-01408

RELATIONSHIP OF WATER QUALITY AND SOIL PROPERTIES TO SEEPAGE PROBLEMS,
Seepage Control, Inc., Phoenix, Ariz.
J. Harlan Glenn.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 1-7, 1969. 7 p, 11 fig, 7 ref.

Descriptors: *Seepage, *Reservoir leakage, *Water quality, *Soil water movement, Expansive clays, Ion exchange, Grouting, Leakage, Linings, Permeability, Soil sealants, Surface sealing, Water loss.
Identifiers: Permeability control, Seepage control.

Actual reservoir seepage is often 5-10 times as high as predicted by laboratory tests. Usually the differences are because the contractor does not obtain the compaction of soil assumed by the laboratory and because the effect of water quality on seepage is not determined. Essentially, the permeability of clay-bearing soil is low when in equilibrium with water containing a high proportion of Na to Mg+ Ca, and high in equilibrium with water containing a low proportion of Na. Increases in total salt concentration tend to increase permeability. Treatment of soils with salts or cement can control permeability as well as swelling and cracking properties. (Knapp-USGS)
W70-01415

RECHARGE FROM INDUCED STREAMBED INFILTRATION UNDER VARYING GROUNDWATER LEVEL CONDITIONS,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics; and Minnesota Univ., Minneapolis. Water Resources Research Center.
W. C. Walton.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 17-22, 1969. 6 p, 5 fig, 1 tab. OWRR Project A-014-MINN.

Descriptors: *Induced infiltration, *Surface-groundwater relationships, *Analog models, Recharge, Drawdown, Water levels, Water level fluctuations, Model studies, Analog computers, Pumping, Water wells, Water table, Glacial drift, Aquifers.
Identifiers: Miami River (Ohio).

In evaluating groundwater resources, streambeds must be simulated in mathematical and analog models in such a way that the following conditions are considered: (1) Leakage of water through a streambed is directly proportional to the drawdown beneath the streambed until the water table declines below the streambed. Thereafter, induced infiltration remains constant provided the stream stage and temperature remains stationary; (2) provided that the water table remains below the streambed, leakage of water through a streambed is directly proportional to the average depth of water in the stream and varies with stream-stage changes and changes in the temperature of the surface water. An analog study was made of the outwash aquifer in the Miami Valley, Ohio. With correct streambed simulation, an 8-well collector system resulted in simulated water level declines of over 4 ft along a 5,500 ft reach of the river, but with incorrect streambed simulation, declines exceed 4 ft along only 3,200 ft of river. (Knapp-USGS)
W70-01417

CHANGES IN WATER QUALITY DURING SEEPAGE,
California Univ., Davis. Dept. of Water Science and Engineering; and Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
D. R. Nielsen, and R. D. Jackson.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 8-13, 1969. 6 p, 5 fig.

Descriptors: *Leaching, *Ion exchange, *Biodegradation, Solutes, Soil water movement, Water quality, Permeability, Clays, Soils, Ion transport, Mass transfer, Tracers, Tracking techniques, Laboratory tests.
Identifiers: Water quality alteration.

Water quality is changed when the soil solution interacts with soil particle surfaces during seepage. The interaction is influenced by particle charge, mineralogy, and particle geometry. Experiments were conducted on altering the efficiency of the ion exchange process by altering seepage rates at various depths in soil profiles. The rates of movement of solutes vary considerably, so the use of single-tagged components as tracers yields relatively little information. Leaching columns are used to study decomposition of organic solutions passing through soil. (Knapp-USGS)
W70-01418

REVIEW OF METHODS FOR MEASURING AND PREDICTING SEEPAGE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Herman Bouwer, and Robert C. Rice.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 115-120, 1969. 6 p, 1 tab, 12 ref.

Descriptors: *Seepage, *Canal seepage, *Soil water movement, Mathematical studies, Tracers, Tracking techniques, Ions, Water loss, Hydrologic budget, Water balance, Steady flow, Unsteady flow, Groundwater movement, Analog models, Computer models.
Identifiers: *Seepage forecasting.

Methods for measuring and predicting seepage from open channels are reviewed. They include the inflow-outflow, ponding, seepage meter, salt penetration, and mathematical techniques. Quantitative information of seepage losses from irrigation or natural channels can be obtained by direct measurement on the channel or by calculation. The second approach, in which seepage is calculated from the hydraulic conductivity of the soil materials and the boundary conditions of the flow system, will be of particular value for canals that are still in the planning stage, for example, in determining desired canal capacities or canal locations for minimum total seepage losses. The methodology for direct measurement or calculation of seepage from channels or reservoirs has progressed sufficiently to enable acquisition of quantitative seepage data for a wide variety of conditions. (Knapp-USGS)
W70-01420

FIELD EVALUATION OF SEEPAGE MEASUREMENT METHODS,
Idaho Univ., Moscow. Dept. of Civil Engineering; and Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
C. E. Brockway, and R. V. Worstell.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 121-127, 1969. 7 p, 3 fig, 2 tab.

Descriptors: *Canal seepage, *Infiltration, Soil water movement, Groundwater movement, Hydrologic budget, Water balance, Flowmeters, Streamflow, Surface-groundwater relationships, Statistical methods, Irrigation.
Identifiers: *Seepage meters.

Ponding tests, seepage meters, and inflow-outflow methods of measuring seepage from canals are described and evaluated. The study was performed in 1965 and 1966 on a 4.5-mile reach of the A and B Irrigation District Main Canal near Paul, Idaho. It is 25 to 30 ft wide with a gradient of about 0.5 ft per mile and flows at a depth of 5 to 5.5 ft during the irrigation season. Soils throughout the test reach are very uniform and consist almost entirely of Portneuf silt loam. A compacted, slightly cemented silt layer from 12 to 24 inches thick intersects the canal cross section throughout most of the test reach. The flow system beneath the entire test reach is under tension gradients due to an impending layer near the soil surface of the canal cross section. Devices for recording water measurement were installed at the inlet and outlet and at all turnouts on the reach. A water budget for the irrigation season was maintained on this reach for 3 yr, and the loss rates for 2-wk periods were computed. Of the available methods for evaluating seepage losses, the ponding test is the most accurate but the most expensive. The use of seepage meters for obtaining estimates is fast and economical. Inflow-outflow methods are usually too expensive to be used for short-duration seepage measurements. (Knapp-USGS)
W70-01422

SEEPAGE DETECTION BY REMOTE SENSING,
HRB Singer, Inc., State College, Pa. Radiometric Lab.
For primary bibliographic entry see Field 07B.
W70-01423

SUBSURFACE FLOW REGIMES OF A HYDROLOGIC WATERSHED MODEL,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02A.
W70-01424

INFLUENCE OF CAPILLARY GROUND MOISTURE ON EOLIAN ACCUMULATION OF LOESS,
Wroclaw Univ. (Poland). Faculty of Geography.
For primary bibliographic entry see Field 02J.
W70-01440

FORMATION AND STABILITY OF AL, FE, AND MG INTERLAYERS IN MONTMORILLONITE AND VERMICULITE,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 02K.
W70-01457

2H. Lakes

HYDROGRAPHY OF THE BALTIC DEEP BASINS III,
Fishery Board of Sweden.
For primary bibliographic entry see Field 02L.
W70-01245

TEMPERATURE OF SURFACE WATERS IN MONTANA,
Geological Survey, Helena, Mont.
For primary bibliographic entry see Field 07C.
W70-01250

TRULLVATNET: A FLANDRIAN STRATIGRAPHICAL SITE NEAR MURCHISONFJORDEN, NORDAUSTLANDET, SPITSBERGEN,
Helsinki Univ. (Finland). Dept. of Geology and Paleontology.
Hannu Hyvarinen.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 42-45, 1969. 4 p, 4 fig, 14 ref.

Descriptors: *Lakes, *Sediments, *Stratigraphy, *Radioactive dating, Geology, Clays, Mud, Sulfides, Mollusks, Shellfish, Radiochemical analysis, Diatoms, Lagoons, Lake basins, Sampling, Mapping, Core drilling, Shores, Structural analysis.
Identifiers: *Spitsbergen, Trullvatnet Lake.

A sediment core from Trullvatnet Lake of Murchisonfjord area was examined. The sediments of this 3 m-long core cover a period of about 7000 years, as determined by a C-14 analysis, and show a sequence of two marine-lacustrine contacts in the lower region. The core indicates the renewed connection with the sea of the basin between about 5500 and 4745 years ago. This connection was followed by a final isolation suggesting an interruption in the general trend of shoreline displacement. (Gabriel-USGS)
W70-01253

A TYPE OF CIRCULAR LAKES IN NORTHERNMOST NORWAY,
Lund Univ. (Sweden). Dept. of Physical Geography.
Harold Svensson.
Geografiska Annaler, Ser A, Phys Geogr, Vol 51A, No 1-2, p 1-12, 1969. 12 p, 12 fig, 21 ref.

Descriptors: *Lakes, *Geomorphology, *Permafrost, Frost action, Altitude, Climates, Carbon, Radioactivity, Mapping, Geology, Cracks, Frequency analysis, Erosion, Glaciation.
Identifiers: *Northern Norway, Palsas, Pingos.

This paper discusses the palsas, pingo-like frost mounds, and circular to oval lakes having characteristics of both the palsa and the pingo groups in northeastern Scandinavia. The lakes differ from other lakes of regular shape by being enclosed by a low, uniform wall. Palsas are the most frequent permafrost features in Scandinavia. Palsas are dry low ridges, usually in bogs. The circular lakes are interpreted as a collapse stage of frost mounds originated as palsas or as pingos. Climatological and temporal factors are analyzed to explain the collapse features and fossil, low-elevation rings, present in the area. (Gabriel-USGS)
W70-01256

WATER TEMPERATURES IN A SHALLOW LAKE DURING ICE FORMATION, GROWTH AND DECAY,
Army Terrestrial Sciences Center, Hanover, N.H.
M. A. Bilello.
CRREL, Research Report 213, Dec 1967. 24 p, 15 fig, 34 ref.

Descriptors: *Lake ice, *Lake temperatures.

Continuous water temperature measurements were made in a shallow lake in upper Michigan prior to and during ice formation, and during ice growth and decay. Several full circulations or 'overturns' at 4 deg C were observed during autumn and the temperature throughout the lake just prior to complete freeze-over reduced to a minimum of+0.2 deg C. After a permanent ice cover had formed, the water beneath the ice began to warm up. Within a 25-day period during December the water temperature near the bottom of the lake increased from+0.3 deg C to 3.0 deg C. Quantitative analysis of this heat gain showed that it came principally from the energy stored during the summer in the underlying soils. Evaluation of the effect of solar radiation demonstrated that the sun during December contributed very little heat to the water because of the absorption qualities of the cover of snow and bubbly ice. During the ice thaw period in April a unique reduction in temperature was recorded throughout the main mass of water. Since the lake is thermally stratified, it was assumed that this cooling could only result from mechanical action in the water. This phenomenon probably takes place as the surface water from melting snow around the area flows into the lake and causes overturning. (Upadhyaya-Vanderbilt)
W70-01393

RECORD LOW DISSOLVED OXYGEN IN THE ISLAND AREA OF LAKE ERIE,
Ohio State Univ., Columbus. Coll. of Biological Sciences; and Ohio State Univ., Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 05C.
W70-01425

PRIMARY PRODUCTIVITY - PHYTOPLANKTON RELATIONSHIPS, HODGSON LAKE, PORTAGE COUNTY, OHIO,
Kent State Univ., Ohio. Dept. of Biological Sciences.
For primary bibliographic entry see Field 05C.
W70-01426

NUTRIENT LIMITATION OF SUMMER PHYTOPLANKTON GROWTH IN CAYUGA LAKE,
Cornell Univ., Ithaca, N.Y.
D. H. Hamilton, Jr.
Limnology and Oceanography, Vol 14, No 4, p 579-590, July 1969. 3 fig, 9 tab, 32 ref.

Descriptors: *Phytoplankton, *Limiting factors, *Nutrients, *Primary productivity, Phosphates, Silicates, Citrates, Bioassay, New York, Lakes, Inhibition, Algae, Diatoms, Eutrophication, Carbon radioisotopes, Chlorophyll, Hydrogen ion concentration, Magnesium, Calcium.
Identifiers: *Enrichment experiments, *Nutrient limitation, Cayuga Lake (NY), Asterionella formosa, Synedra, Melosira, Dinobryon, Fragilaria, Radiocarbon method, Finger Lakes (NY), Rodhe's solution VIII, Nutrient limitation, Carbon-14.

Author describes experiments performed to determine the effect of defined culture medium components on natural phytoplankton populations. Samples collected from Cayuga Lake (Ithaca, New York) at 2-3 day intervals from 20 July through 18 August were placed in an enrichment medium (Rodhe's solution VIII). Assimilation was measured with radiocarbon (C-14). Major algal culture components were Asterionella formosa and unidentified species of Synedra, Melosira, Dinobryon, and Fragilaria. Results indicated an enhancement effect with calcium nitrate, due apparently to the calcium element. Magnesium sulfate and ferric citrate-citric acid were irregularly inhibitory. Phosphate failed to stimulate cultures and occasionally proved inhibiting. Nutrient combinations yielded variable results; author states this may be due to phenomena peculiar to the sample bottles or to changing composition and alternatively, due to physiology of the phytoplankton populations. Tabular data include results and summary of enrichment experiments. (Voightlander-Wisconsin)
W70-01579

PHOSPHATE ADSORPTION AND ISOTOPIC EXCHANGE IN LAKE MUDS,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
Sigurd Olsen.
International Association of Theoretical and Applied Limnology, Proceedings, Vol 13, p 915-922, Feb 1958. 8 fig.

Descriptors: *Lakes, *Phosphates, *Adsorption, *Phosphorus radioisotopes, *Oxidation-reduction potential, Iron compounds, Cycling nutrients,

Water pollution sources, Carbonates, Sediment-water interfaces, Calcium, Oligotrophy, Eutrophication.
Identifiers: *Phosphorus fixation, *Phosphorus-32, *Phosphorus-31, *Isotopic exchange, *Lake muds, Ferrous sulfide, Chemisorption, Freundlich isotherm, Specific activity, Contact time, Denmark, Lake Fureso (Denmark), Lake Grane Langso (Denmark).

Equilibration of phosphate between water and sediment depends on many factors: temperature, redox potential, contents of iron and calcium, and the contact time. The described method, using radiophosphorus (P-32), permits simultaneous appraisal of opposing processes occurring in liquid and solid phases of the lake at welldefined oxidation-reduction levels. In the presence of oxidized sediments, the phosphate equilibrium may be expressed as the difference between its gross adsorption, following the Freundlich isotherm, and its liberation. The presence of iron in reduced sediments precludes a mathematical expression of the processes. (Wilde-Wisoncsin)
W70-01581

LIMNOLOGICAL EFFECTS OF FERTILIZING BARE LAKE, ALASKA,
Washington Univ., Seattle. Dept. of Zoology.
Philip R. Nelson, and W. T. Edmondson.
Fishery Bulletin of the Fish and Wildlife Service, No 102, p 415-436, 1955. 6 fig, 5 tab, 53 ref.

Descriptors: *Photosynthesis, *Limnology, *Alaska, *Fertilization, *Hydrogen ion concentration, *Eutrophication, Nutrients, Fish management, Primary productivity, Secondary productivity, Zooplankton, Phytoplankton, Oxygen, Transparency, Water pollution effects, Rotifers, Planktonic crustaceans, Salmon, Biomass.
Identifiers: *Bare Lake (Alaska), *Sodium nitrate, *Superphosphates, Ploesoma truncatum, Keratella cochlearis, Biotic relationships, Fish growth, Secchi disc transparency, Light-and-Dark bottle techniques.

Results are reported of experiment in which Bare Lake, Alaska (49 hectares; depth: mean--4.0 meters, maximum--7.5 meters) was fertilized with objective of bolstering a declining salmon fishery. Application of 2960 kilograms sodium nitrate and 1135 kilograms superphosphate (19%) annually during four successive years resulted in large increases in photosynthesis rate. Following each annual fertilizer application, phytoplankton increased manyfold and the transparency (Secchi disc) decreased from about 6 to less than 2 meters. The pH of water increased from 7.0 to 9.0. Rates of photosynthesis (dark and light bottle) were increased by factors of 2.5 to 7 in period 10 days after fertilization as compared to similar pre-fertilization interval. Egg production of rotifers apparently increased as result of augmented food supply. Failure of planktonic crustaceans to significantly increase their population size during 1950-1952 period might be attributed to their long life cycle and effectiveness of their predators. Contents of nitrates and phosphates fell to undetectable levels in a few days after application of salts. Salmon leaving the lake were longer and heavier in successive years, suggesting a response to increased food supply. (Wilde and Eichhorn-Wisconsin)
W70-01583

2I. Water in Plants

ROOT SURVEY METHODS FOR HYDROLOGICAL EXPERIMENTS,
Ministry of Works, Wellington (New Zealand); and Geological Survey, Denver, Colo.
G. J. Blake, and F. A. Branson.
J Hydrol (New Zeal), Vol 8, No 1, p 3-7, 1969. 5 p, 15 ref.

Descriptors: *Root systems, *Soil-water-plant relationships, *Reviews, Bibliographies, Surveys, Laboratory tests, Root distribution, Root development, Tracers, Water utilization, Water balance, On-site tests.
Identifiers: Root (Plant) surveys.

The roots of a plant are those parts which are normally below the surface of the soil. Root distribution is a very important factor in many hydrological studies and may be defined by the volume and/or weight of roots present, their mode of branching and diameter, their vertical distribution, and their lateral distribution in the soil profile. Evapotranspiration, infiltration, soil moisture and ground water are all affected by the presence or absence of roots. The primary functions of the root are anchorage, the absorption of water and inorganic salts in solution, the conduction of these to the stem, and the modification of moisture stresses and porosity of the soil. The root survey methods reviewed are trench profiles, monoliths, soil cores, tracer studies, soil moisture studies, and various laboratory methods. (Knapp-USGS)
W70-01439

2J. Erosion and Sedimentation

BRAHMAPUTRA RIVER: CHANNEL PROCESSES AND SEDIMENTATION,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
James M. Coleman.
Sediment Geol, Vol 3, No 2/3, p 129-239, Aug 1969. 111 p, 48 fig, 7 tab, 58 ref. Proj No Nonr 1575 (03), Task Order No NR 388 002.

Descriptors: *Sediment transport, *Streamflow, *Bed load, *Channel morphology, Meanders, Braiding, Sediment load, Deltas, Sand waves, Sedimentary structures, Hydrologic data, Alluvial channels.
Identifiers: *Brahmaputra River, *India, *Pakistan.

The Ganges and Brahmaputra Rivers combined have formed a 23,000 sq mi delta, one of the largest in the world. These rivers originate within the Himalayan Mountains, and drain an enormous land area before entering East Pakistan. The combined rivers carry nearly 6 million cusecs of water to the Bay of Bengal. The rivers are heavily charged with sediment, transporting approximately 13 million tons of suspended sediment per day during flood. The large discharge and heavy sediment load cause the rivers to be extremely unstable, and the channels are constantly migrating laterally. The long-term patterns of river migration indicate that the Ganges has been migrating eastward, whereas the preferred migration of the Brahmaputra is westward. The Brahmaputra River displays a braided pattern in plan view, and short-term channel migration is quite drastic, with rates of movement as high as 2,600 ft a year being common. During low-river stage, trenches on the various exposed bars revealed the type of bedding formed by migration of the various bedforms. Crossbedding measurements at these stations were recorded and compared to sand body trends. The combined Bengal Basin rivers deliver some 1 billion tons of suspended sediment a year to the Bay of Bengal. Most of the sediment brought to the bay bypasses the bar and continues on into deeper water through a canyon. Thus in deep water a subaqueous delta is being formed that dwarfs the subaerial delta. (Knapp-USGS)
W70-01242

ON THE GEOMETRY OF CURRENT RIPPLES IN RELATION TO STABILITY OF FLUID FLOW,
Reading Univ. (England). Sedimentology Research Lab.
For primary bibliographic entry see Field 02E.
W70-01243

TRULLVATNET: A FLANDRIAN STRATIGRAPHICAL SITE NEAR MURCHISONFJORDEN, NORDAUSTLANDET, SPITSBERGEN,
Helsinki Univ. (Finland). Dept. of Geology and Paleontology.
For primary bibliographic entry see Field 02H.
W70-01253

TILL FABRIC ANALYSES FROM THE LOTHIANS, CENTRAL SCOTLAND,
Edinburgh Univ. (Scotland). Dept. of Geography.
For primary bibliographic entry see Field 02C.
W70-01254

A TYPE OF CIRCULAR LAKES IN NORTHERNMOST NORWAY,
Lund Univ. (Sweden). Dept. of Physical Geography.
For primary bibliographic entry see Field 02H.
W70-01256

MUD FLOW STUDIES (RUSSIAN),
For primary bibliographic entry see Field 02A.
W70-01276

EVOLUTION DES VERSANTS CARTOGRAPHIE GEOMORPHOLOGIQUE DYNAMIQUE FLUVIALE: VOLUME 1, EVOLUTION DES VERSANTS (FRENCH),
P. Macar.
Evolution Des Versants, Proc Symp Int de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, Liege Univ, 1967. 384 p, 118 fig, 9 photo, 9 tab, 156 ref.

Descriptors: *Slopes, *Erosion, *Deposition (Sediments), *Geomorphology, Animals, Forests, Igneous rocks, Weathering, Climates, Mapping, Soil dynamics, River basins, Watersheds (Basins).
Identifiers: River basin slope evolution.

This volume is a collection of 23 articles on various aspects of slope evolution presented at the International Geographic Union Convention in Liege and Louvain, Belgium, on June 8-16, 1966. Six additional articles describe the pertinent information observed by the members of the Convention during their six one-day field trips. (Gabriel-USGS)
W70-01277

PRESENT EVOLUTION OF SLOPES IN THE CARPATHIANS USING FIXED OBSERVATIONS AS AN EXAMPLE (FRENCH),
T. Gerlach.
Evolution Des Versants, Proc Symp de Germorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 129-138, Liege Univ, 1967. 3 fig, 2 photo, 7 ref.

Descriptors: *Geomorphology, *Slopes, *Erosion, *Mass wasting, Streamflow, Gravity, Soils, Washouts, Leaching, Creep, Ice, Freezing, Winds, Wind velocity, Vegetation effects, Forests, Infiltration, Biochemistry, Pleistocene epoch.
Identifiers: *Poland, Carpathians, Slope evolution.

The present evolution of slopes was investigated for a 4-year period using a small stream basin of 23 sq kw, located in the Polish area of the Carpathians. The rate of contemporary slope changes varies from place to place. The most important processes modifying the slopes are stream erosion and gravity mass movements, slumping in particular. Besides slumping the following processes (given in order of their importance) influence the evolution of slopes: soil washing; solution and leaching; soil creep; displacement through needle-ice; and uprooting of trees by wind action. In cultivated areas the periglacial slopes are subject to particularly rapid transformation. In areas under permanent vegetation cover (meadows and forests), soil washing, soil creep, and displacement through needle-ice are insignificant. Forested slopes and slopes covered by meadows favor water infiltration, leaching, and

biochemical processes, although all these processes do not significantly change the existing slope profiles. (Gabriel-USGS)
W70-01278

INITIAL RESULTS OF THE ANALYTIC STUDY OF SURFACE RUNOFF AND EROSION IN THE SAHARA ZONE - KOUNTKOUZOUT BASIN (NIGER) AS AN EXAMPLE (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
For primary bibliographic entry see Field 02E.
W70-01279

REEVALUATING THE MEASUREMENTS OF SOLID DISCHARGES IN SUSPENSION, REPUBLIC OF CHAD (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
Bernard Billon.
Cahiers ORSTOM Ser Hydrol, Vol 5, No 2, p 3-13, 1968. 5 fig, 7 tab.

Descriptors: *Suspended load, *Suspension, *Discharge measurement, *Discharge (Water), Measurement, Hydrologic data, Laboratory equipment, Analytical techniques, Analysis, Density, Streamflow, Salinity, Chlorides, Temperature, Humidity, Lakes, Rivers, Floods.
Identifiers: Republic of Chad, Chari River, Lake Chad.

The work done by the French Office of the Scientific and Technical Researchs Overseas, in the Chad Republic is described. The discussion includes: (1) the method; (2) the causes of the errors involved in the measurements; (3) measurement scheme; and (4) the results of 4 measurements recorded on the Chari River at Fort-Lamy. The concentration of solid particles in suspension in the Chari River increases from surface to bottom with transversal variations of 30 to 50% in a distance of a few tens of meters. Mean concentrations of these suspended particles in the waters of the Chari River decrease rapidly at the end of August and then increase slowly, without being strongly affected by the abruptly rising waters of October 15. (Gabriel-USGS)
W70-01281

A MATHEMATICAL MODEL FOR THE DESCRIPTION OF THE OPTICAL PROPERTIES OF TURBID WATER IN TERMS OF SUSPENDED PARTICLE SIZE AND CONCENTRATION,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Jerome Williams.
Tech Rep 47, Chesapeake Bay Inst, Johns Hopkins Univ, Ref No 68-17, Nov 1968. 16 p, 6 fig, 5 ref. Available from Clearinghouse as AD-679 168 for $3 in paper copy, 65 cents in microfiche. Proj No NR 083-016, Contract No Nonr 4010 (11).

Descriptors: *Turbidity, *Suspended load, *Mathematical models, *Estuaries, Streams, Bays, Statistical models, Mathematical studies, Optical properties, Opacity.
Identifiers: Underwater transparency, Water transparency, Suspended sediments.

A mathematical model is developed for a hypothetical suspensoid of particulate matter in water. The assumptions are that the particles are homogeneously distributed throughout the medium, the particles all are the same size, and they are all spherical in shape. The resulting expressions relate the particle radius and concentration to extinction coefficient, beam attenuance coefficient, and upwelling light. A logarithiconormal distribution is developed. It is concluded that this model does not supply enough data to determine the statistical parameters of this distribution. (Knapp-USGS)
W70-01285

DETERMINATION OF PARTICLE SIZE AND CONCENTRATION FROM PHOTOMETER AND SECCHI DISC MEASUREMENTS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Jerome Williams.
Tech Rep 48, Chesapeake Bay Inst, Johns Hopkins Univ, Ref No 68-18, Nov 1968. 12 p, 3 fig, 3 ref. Available from Clearinghouse as AD-679 169 for $3 in paper copy, 65 cents in microfiche. Proj No NR 083-016, Contract No Nonr 4010 (11).

Descriptors: *Turbidity, *Particle size, *Photometry, *Mathematical models, Opacity, Instrumentation, Estuaries, Bays, Suspended load, Sea water, Optical properties, Light intensity.
Identifiers: Submarine photometers, Secchi disc.

The mathematical model developed by the Chesapeake Bay Institute is extended to allow for direct calculation of particle size and concentration from optical data. The optical parameters utilized are such that black and white Secchi Discs coupled with a submarine filter photometer are the only instruments required to determine equivalent optical radii and particle concentration values. (Knapp-USGS)
W70-01286

THE ROLE OF THE EQUILIBRIUM CONCEPT IN THE INTERPRETATION OF LANDFORMS OF FLUVIAL EROSION AND DEPOSITION,
Maryland Univ., College Park.
Frank Ahnert.
Evolution Des Versants, Proc Symp Int de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 23-41, 1967. 19 p, 8 fig.

Descriptors: *Equilibrium, *Geomorphology, *Erosion, *Deposition (Sediments), Topography, Mathematical studies, Climatology, Dynamics, Slopes, Slope stabilization, Weathering, Bedrock, River basin development, Energy.
Identifiers: *Landform dynamics.

The role of the dynamic equilibrium concept in the interpretation of landforms of fluvial erosion and deposition was analytically investigated, neglecting at first the effect of climate, structure, and differential rock resistance. This partial neglect was based on the belief that these factors only modify the removal-supply relationship without invalidating the system concept of relating the rates of supply and removal of the waste to the landform. This concept of equilibrium recognizes the balance of energy entering and leaving the system, where the rates of waste supply and waste removal are merely the measurable expression of this balance. Moreover, this concept of equilibrium permits, besides the continuous passing through of exogenic energy, the discontinuous insertion of endogenic energy in the form of tectonic deformation into the system. (Gabriel-USGS)
W70-01288

QUANTITATIVE RESEARCH OF SLOPE DEVELOPMENT IN CZECHOSLOVAKIA,
Czechoslovak Academy of Sciences, Brno. Inst. of Geography.
J. Demek.
Evolution Des Versants, Proc Symp Int de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 111-122, 1967. 12 p, 3 fig, 2 photo, 7 ref.

Descriptors: *Geomorphology, *Slopes, *Slope stabilization, Sediments, Pleistocene epoch, Tertiary period, Erosion, Organic wastes, Soils, Climates, Topography, Plants, Animals, Geology, Runoff, Weathering, Mass wasting.
Identifiers: *Czechoslovakia, Slope development.

Quantitative research on the slope evolution in Czechoslovakia is reviewed. The research consisted of the following broad studies: evolution of the Pleistocene slopes based on the study of correlative deposits; evolution of slopes subjected to cultivation; and the study of slope processes using experimental stream basins. Pleistocene sediments preserved the Tertiary slopes and the thickness of these sediments gives definite data on the importance of the process of denudation. The presence of organic and inorganic material and the petrographic study of these sediments permits the identification of several stages of slope evolution. Data of slope evolution recorded at three experimental areas of central and western Czechoslovakia are included. (Gabriel-USGS)
W70-01289

CURRENT RIPPLES - THEIR RELATION TO PATTERNS OF WATER AND SEDIMENT MOTION,
Reading Univ. (England). Sedimentology Research Lab.
John R. L. Allen.
Amsterdam, North-Holland Publishing Co, 1968. 433 p, 443 fig, 15 tab, 538 ref.

Descriptors: *Deposition (Sediments), *Ripple marks, *Sedimentary structures, *Currents (Water), Sand waves, Flow nets, Flow separation, Dispersion, Sediment transport, Flow around objects, Eddies, Bed load, Sediment distribution, Shape, Laboratory tests.
Identifiers: *Reference book, *Current ripples, *Sediment motion, Cross-stratification.

A detailed description of the geometry and occurrence of ripple marks is given in this 19-chapter well written book based upon field and laboratory studies. Several aspects of current ripples are discussed: theory on fluid motion and sediment transport; description of bed forms, their surface anatomy and cross-stratification; fluid and grain motion associated with specific types of ripples; and sedimentation associated with current ripples. The author's analysis shows how streambed geometry and flow properties are related; many illustrations are given of novel fluid motions obtained. Experiments described show that many textural and geometrical properties of deposits can be understood in terms of diffusion and convection of sediments in areas of separated flow. This book gives the geologist and engineer an intellectual challenge and insight into patterns of water and sediment motion. (Lang-USGS)
W70-01292

MOVEMENT OF SOIL MASS ON SLOPES IN CULTIVATED AREAS,
Warsaw Univ. (Poland).
A. Jahn.
Evolution Des Versants, Proc Symp de Geomorphologie, Liege-Louvain, Belgium, June 8-16, 1966, Vol 40, p 157-165, 1967. 9 p, 5 fig, 8 ref.

Descriptors: *Mass wasting, *Movement, *Slopes, *Cultivated lands, *Erosion, Runoff, Solifluction, Agricultural watersheds, Surface runoff, Washouts, Geology, Clays, Sands, Loess, Silts, River basins, Mass transfer, Soil physical properties, Soil erosion.
Identifiers: Soil mass movement in cultivated areas.

Soil movement on slopes induced by plowing, rain, and surface runoff was investigated by recording pertinent data in the upper Oder River basin of Poland with cultivated slopes of 3 to 18 degrees. Analysis of the process of selective erosion was based on the application of the formula developed by G. W. Musgrave (1947). Selective erosion is stronger on cultivated slopes and is present under natural conditions on the slopes of periglacial areas. On slopes of 10 deg, where plowing is parallel with contour lines, the thickness of the layer shifted annually as much as 10 cm. (Gabriel-USGS)
W70-01295

DEPOSITION IN THE PROCESS OF HYDRAULIC TRANSPORT,
R. A. Bagnold.
Sedimentology, Vol 10, No 1, p 45-56, Jan 1968. 12 p, 6 fig, 8 ref.

Descriptors: *Sedimentation, *Sediment transport, *Deposition (Sediments), Hydraulics, Turbulent flow, Bed load, Suspended load, Particle size, Particle shape, Turbulence, Tractive forces, Laboratory tests, Hydraulic models.
Identifiers: Sediment transport theory.

A simple theory is outlined, based on the conservation of energy, whereby such diverse processes as wind-blown and river-transported sediments, mudflows and sand avalanches can be brought together and explained in terms of the established concepts of general physics. It is shown that the mean rate of transport of sediment in turbulent suspension is determined by the whole size distribution of the transported sediment rather than by any arbitrarily defined mean size. This suggests that more detailed studies of the changes which occur in size distributions during the cycle of erosion transport and deposition would throw much-needed light on the underlying processes. (Knapp-USGS)
W70-01409

STATISTICAL MODELS IN SEDIMENTOLOGY,
Northwestern Univ., Evanston, Ill.
W. C. Krumbein.
Sedimentology, Vol 10, No 1, p 7-23, Jan 1968. 17 p, 4 fig, 4 tab, 27 ref.

Descriptors: *Statistical models, *Sedimentology, *Reviews, Sedimentation, Regression analysis, Stochastic processes, Computers, Mathematical models, Statistical methods, Systems analysis, Probability.
Identifiers: Sedimentological model studies, Statistical sedimentology.

Three stages of statistical development can be recognized in sedimentology. The first is descriptive statistics, in which the sample is the object of interest, and the second is analytical statistics, in which the population assumes major importance. A very large variety of statistical techniques is available for estimating mean values, degrees of variability, tests of differences among population means, linear relations (correlations) among the variables, and ways of evaluating areal variations (trends) in sedimentary phenomena. The third stage of statistical development is the application of stochastic process models to sedimentology, in which the objective is to discern the probabilistic elements is sedimentary processes, in part by simulation with the high-speed computer. Stochastic process models thus provide one way of examining sedimentary processes through time or over an area. In conjunction with deterministic models they provide a framework for exploring the underlying physical, chemical, and biological controls on sedimentary processes and deposits, with superimposed random fluctuations introduced by the 'built in' probabilistic mechanism. (Knapp-USGS)
W70-01411

ON ENVIRONMENT-SENSITIVE GRAIN-SIZE PARAMETERS,
Leiden Rijksuniversiteit (Netherlands). Dept. of Sedimentology.
W. S. Koldijk.
Sedimentology, Vol 10, No 1, p 57-69, Jan 1968. 13 p, 8 fig, 16 ref.

Descriptors: *Sediments, *Deposition (Sediments), *Particle size, *Statistical methods, *Computer programs, Sediment transport, Alluvial channels, Sampling, Settling velocity, Regime.
Identifiers: Sorting (Sediments), Moments (Statistical), Spain.

Moment measures are to be preferred over graphic measures for a reliable description of the depositional environment of sands. This is demonstrated by coarse beach and river sands from the Ria de Arosa (northwestern Spain). A PL/1 computer-program for the calculation of graphic and moment measures has been added to stimulate other comparative studies. (Knapp-USGS)
W70-01412

ANALYSIS OF THE RELATIONSHIP BETWEEN ACOUSTIC REFLECTIVITY AND SEDIMENT POROSITY,
Lafayette Coll., Easton, Pa. Dept. of Geology; and General Dynamics Corp., Groton, Conn. Electric Boat Div.
Richard W. Faas.
Geophysics, Vol 34, No 4, p 546-553, Aug 1969. 8 p, 6 fig, 4 tab, 13 ref. ONR Contract Nonr 2512 (00).

Descriptors: *Acoustics, *Porosity, *Sediments, *Physical properties, Mechanical properties, Sounding, Sound waves, Exploration, Geophysics, Clays, Sands, Gravels, Bottom sediments.
Identifiers: Acoustic reflectivity (Sediments).

Ocean-bottom sediment porosity and acoustic reflectivity are related by a simple linear equation. The equation was derived empirically from data published by several investigators and is valid for a wide variety of sediment types and ocean conditions. The degree of validity of the relationship appears to be excellent as the correlation coefficient between the porosity and acoustic reflectivity is 0.97. (Knapp-USGS)
W70-01428

INTER-ELEMENT ASSOCIATIONS IN SOME PELAGIC DEPOSITS,
Ottawa Univ. (Ontario). Dept. of Geology.
D. S. Cronan.
Chem Geol, Vol 5, No 2, p 99-106, Nov 1969. 8 p, 2 tab, 21 ref.

Descriptors: *Sediments, *Water chemistry, *Correlation analysis, *Trace elements, Spectroscopy, Chemical analysis, Manganese, Bottom sediments, Clays, X-ray diffraction, Mineralogy.
Identifiers: Pelagic sediment chemistry, Manganese nodules, Electron-probe analysis.

Calculation of correlation coefficients for various pairs of elements in pelagic deposits demonstrates the presence of several inter-element associations. In manganese nodules these are between Mn-Ni-Cu-Mo, Cr-detrital constituents, Co-Pb and Fe-Ti, and in pelagic sediments between V-Cr-Ti and Mn-Ni-Mo. These associations are considered to result largely from the partition of elements between the different mineral phases present in the deposits, and, in the case of the nodules, from variations in their depth of formation. (Knapp-USGS)
W70-01438

INFLUENCE OF CAPILLARY GROUND MOISTURE ON EOLIAN ACCUMULATION OF LOESS,
Wroclaw Univ. (Poland). Faculty of Geography.
J. Cegla.
Bull Acad Pol Sci, Ser Sci Geol et Geogr, Vol 17, No 1, p 25-27, 1969. 3 p, 10 ref.

Descriptors: *Capillary water, *Moisture, *Groundwater, *Loess, *Sedimentation, Geology, Topography, Vegetation, Cold regions, Deserts, Petrography, Aeolian soils.
Identifiers: *Poland, Loess accumulation processes.

In many parts of the world, loess deposits blanket uplands and elevated topographical elements. The presence of moisture in the ground may be of primary importance for the accumulation of loess on elevated topographical elements; however, this suggestion does not invalidate the widely accepted view that the climate conditions present during the accumulation of loess were cold and relatively dry. (Gabriel-USGS)
W70-01440

DEVELOPMENT OF EOLIAN TRANSVERSE RIPPLES AND RIPPLE BEDDING,
Polish Academy of Sciences, Warsaw. Museum of the Earth.
J. Muller.
Bull Acad Pol Sci, Ser Sci Geol et Geogr, Vol 17, No 1, p 49-56, 1969. 8 p, 4 fig, 18 ref.

Descriptors: *Sedimentary structures, *Aeolian soils, *Ripple marks, *Beds, Seashores, Beaches, Dunes, Hydrodynamics, Mathematical models, Mathematical studies, Stress analysis, Sediment transport.
Identifiers: Ripple mark development.

The conclusions reached during field work carried out mainly on beaches and coastal dunes of the Southern Baltic seashore, and in the laboratory using a simple wind tunnel are summarized. First-stage ripples may be interpreted as local dense concentrations of particles that move closest to the bottom. Development of the second-stage forms is connected with the interaction between the obstacles of the bed and the grainflux. Regular patterns of second- and third-stage ripples develop only in abundance of grains rolling and saltating and in stable conditions of flow. (Gabriel-USGS)
W70-01441

ACTIVATION ANALYSIS OF SEDIMENTARY ROCK,
Texas Petroleum Research Commission; and Texas A and M Univ., College Station.
E. M. Chandler, and Paul B. Crawford.
Bull Acad Pol Sci, Ser Sci Geol et Geogr, Vol 17, No 1, p 73-78, 1969. 6 p, 7 fig, 2 tab, 5 ref.

Descriptors: *Sedimentary rocks, *Sedimentary petrology, *Neutron activation analysis, *Analytical techniques, *Analysis, Thermal radiation, Chemical analysis, Silica, Sodium, Magnesium, Iron, Trace elements, Geology, Shales, Limestones, Sands.
Identifiers: Trace element analysis.

Sedimentary rock samples of shale, limestone, and sand were activated with thermal neutrons, allowed to cool and counted. Under certain conditions requiring no wet chemistry, the contents of Si, Al, Na, Mg, Hf, La, Sc and Fe in sedimentary rocks can be qualitatively determined. Sampling procedures and 10-second, one-minute, and 4-hour activation procedures are described. It is of interest that for a short activation time Si, Al, Mg, and Na peaks effectively mask out all trace elements. (Gabriel-USGS)
W70-01442

2K. Chemical Processes

ON THE POSSIBILITY OF GROUNDWATER AGE DETERMINATION USING TRITIUM-HELIUM-3 METHOD (RUSSIAN),
For primary bibliographic entry see Field 02F.
W70-01282

PROPERTIES OF SEA WATER AND SOLUTIONS CONTAINING SODIUM CHLORIDE, POTASSIUM CHLORIDE, SODIUM SULFATE AND MAGNESIUM SULFATE,
Monsanto Research Corp., Everett, Mass.
B. M. Fabuss, and Alexander Korosi.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $1.25. Office Saline Water Res and Develop Progr Rep No 384, 1968. 133 p. OSW Contract No 14-01-0001-466.

Descriptors: *Water chemistry, Sea water, *Water properties, *Aqueous solutions, Sodium chloride, Potassium chloride, Sodium sulfate, Magnesium compounds, Density, Vapor pressure, Viscosity, Thermal conductivity, Boiling, Brines, Correlation analysis, Computer programs.
Identifiers: *Boiling point elevation, Binary solutions, Ternary solutions.

Density, vapor pressure and viscosity were measured and tabulated for: (1) water; (2) binary solutions (NaCl-KCl, Na sulfate, Mg sulfate); (3) ternary solutions (NaCl-KCl, NaCl-Na sulfate, NaCl-Mg sulfate); (4) sea water and its concentrates. Thermal conductivity data of water and sea water as well as boiling point elevation for sea water are also

given. A FORTRAN program is given to calculate densities, activities, and viscosities of brines. Examples of calculation of each property and the correlation techniques used are given. (Carstea-USGS)
W70-01400

SILICA CONTENT AND SILICA-CLAY INTERACTIONS IN THE WATER OF THE DEAD SEA (ISRAEL),
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
Ora Amit.
Chem Geol, Vol 5, No 2, p 121-129, Nov 1969. 9 p, 4 fig, 4 tab, 7 ref.

Descriptors: *Water chemistry, *Brines, *Water analysis, *Silica, *Clays, Salinity, Saline water, Adsorption, Ion exchange, Mineralogy, Sorption.
Identifiers: *Dead Sea (Israel).

The concentration of silica in Dead Sea water ranges from about 13-17 ppm at the surface to about 8-10 ppm at depth. Contact with various clay minerals reduces the silica content of Dead Sea water to 2-3 ppm. These relations are the opposite of those obtained in ocean water: free ocean water has less than 1/10 the silica content of Dead Sea water, but oceanic interstitial water is about 10 times as rich in silica as the corresponding Dead Sea water. These differences are attributed to the uptake and release of silica by organisms in the ocean and their absence in the Dead Sea and to the influence of salinity on the solubility of clay minerals. (Knapp-USGS)
W70-01405

PROBABLE CHANGES IN THE COMPOSITION OF SEA WATER DURING THE COURSE OF GEOLOGICAL TIME,
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.
A. B. Ronov.
Sedimentology, Vol 10, No 1, p 25-43, Jan 1968. 19 p, 7 fig, 6 tab, 52 ref.

Descriptors: *Geochemistry, *Water chemistry, *Paleohydrology, *Sea water, Oxygen, Oxidation, Ions, Solutes, Aqueous solutions, Oxidation-reduction potential.
Identifiers: Sea water paleogeochemistry.

The geological history of the outer geospheres can be understood only if their chemical interrelationships are taken into account. The excess calcium and magnesium in sedimentary rocks cannot be understood unless the magmatogenous Azoic and Archean volcanic rocks were more mafic than the average composition of the Archean and Proterozoic shields. This leads to the idea that the cationic composition of the ancient ocean was essentially calcium and magnesium. The granitization of the sedimentary mantle in the Upper Archean and Lower Proterozoic was accompanied by the introduction of enormous amounts of alkaline solutions from the mantle into the crust, a growth in the volume of the ocean waters, the beginning of an inversion in the cationic composition and a gradual enrichment in sodium. This developed parallel with the growth of platforms and carbonate deposit formation. The formation of sulfate beds and thick beds of iron ore of the Early Proterozoic was preceded by the oxidation of sulfur and polyvalent metals. These processes were related to the history of carbon dioxide and oxygen in the atmosphere and to the development of life and the biosphere. Thus the Archean-Early Proterozoic boundary marks an epoch of abrupt change in the history of the outer zones of the earth. (Knapp-USGS)
W70-01410

SELECTIVE ELEMENT RECOVERY FROM OIL FIELD BRINES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Ernest E. Angino.
Pap presented at 50th Annu Meeting of Amer Geophys Union, Wash, DC, Apr 21-25, 1969. 13 p, 5 fig, 1 tab.

Descriptors: *Desalination, *Oil fields, *Brines, Elements (Chemical), Sodium compounds, Sulfates, Sulfur, Trace elements, Iron.
Identifiers: *Element recovery, Oil field brines.

More than 250 billion gallons of oil-field brines are brought to the surface yearly in the United States. Most of these brines are wasted and/or are returned to the subsurface without any attempt of stripping the salts. In many instances, the salts in oil-field brines could be extracted profitably, if modern extraction techniques were used. Simple extraction processes for soda ash, sodium carbonate, caustic soda, magnesium and calcium sulfate, trace elements and others are available. Sulfur can be recovered by precipitating the sulfate as $BaSO_4$, which can then be made to yield S by a short 4-step conversion process. Magnesium can be precipitated as the hydroxide and selected trace elements can be scavenged by ferric iron precipitation. (Carstea-USGS)
W70-01413

RELATIONSHIP OF WATER QUALITY AND SOIL PROPERTIES TO SEEPAGE PROBLEMS,
Seepage Control, Inc., Phoenix, Ariz.
For primary bibliographic entry see Field 02G.
W70-01415

CHANGES IN WATER QUALITY DURING SEEPAGE,
California Univ., Davis. Dept. of Water Science and Engineering; and Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W70-01418

ATOMIC ABSORPTION AND FLAME EMISSION SPECTROSCOPY ABSTRACTS.

Atomic Absorption and Flame Emission Spectroscopy Abstracts, Vol 1, No 1, Jan-Feb 1969. Science and Technology Agency, 3 Dyers Bldg, London, EC 1, England.

Descriptors: *Abstracts, *Spectroscopy, *Flame photometry, Geochemistry, Water chemistry, Water analysis, Documentation, Publications, Chemical analysis.
Identifiers: *Atomic absorption spectroscopy, Flame emission spectroscopy.

A bimonthly publication contains abstracts and documentation of all aspects of atomic and flame emission spectroscopy. Topics include theory, instrumentation, technique, elements (chemical), biological applications, industrial applications, and geochemical applications. (Knapp-USGS)
W70-01434

RATES OF REACTION OF DISSOLVED OXYGEN WITH SCAVENGERS IN SWEET AND SOUR BRINES,
Mobil Research and Development Corp., Dallas, Tex.
For primary bibliographic entry see Field 08G.
W70-01435

NITRATE DETERMINATION IN SOIL EXTRACTS WITH THE NITRATE ELECTRODE,
Norges Landbrukshoegskole, Vollebekk. Inst. of Soil Science; and Norges Landbrukshoegskole, Vollebekk. Chemical Research Lab.
A. Oien, and A. R. Selmer-Olsen.
Analyst, Vol 94, No 1123, p 888-894, Oct 1969. 7 p, 5 tab, 23 ref.

Descriptors: *Analytical techniques, *Nitrates, *Soil water, *Aqueous solutions, *Electrodes, Electrochemistry, Ions, Zeta potential, Chemical reactions, Soil chemistry.
Identifiers: Nitrate determination electrodes.

Investigations were made on nitrate determination with a nitrate-specific ion electrode. Analytical results for the nitrate content in soil extracts are compared with analyses carried out by two colorimetric methods. The extracting agents used are 0.02 N copper sulphate, 2 N potassium chloride and distilled water. Results for nitrate determinations in soil suspensions and corresponding filtrates are also compared. The stability of soil extracts, the influence of variation in the ratio of grams of soil to millilitres of extracting agent and in the shaking time, interferences caused by ionic strength and anions, accuracy and reproducibility are also discussed. Nitrate determination with the electrode is reliable both for soil extracts and for soil suspensions. The determination is rapid, and the interferences are not serious. (Knapp-USGS)
W70-01437

INTER-ELEMENT ASSOCIATIONS IN SOME PELAGIC DEPOSITS,
Ottawa Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 02J.
W70-01438

CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION IN SOME REGIONS OF THE USSR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
A. A. Matveyev, and O. I. Bashmakova.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 3-16, 1967. Soviet Hydrology: Selected Papers No 5, p 480-491, 1967. 6 fig, 4 tab, 35 ref.

Descriptors: *Precipitation (Atmospheric), *Water chemistry, *Water quality, *Salts, Chlorides, Sulfates, Bicarbonates, Calcium, Magnesium, Potassium, Sodium, Carbon dioxide, Hydrogen sulfide.
Identifiers: *USSR, *Atmospheric water chemistry, Sulfur dioxide.

The results of chemical analyses of atmospheric waters in the USSR are summarized. Maps are compiled on the average annual mineralization of atmospheric precipitation of salts with atmospheric precipitation per unit area. These maps show the magnitude of these quantities in various regions of the European USSR with an accuracy of about 15-45%. The concentration of marine salts in atmospheric precipitation varies from 60% of the total mineralization of precipitation in the north to 15% in the central part of the country. The influence of continental factors (eolian suspensions, industry, etc.) is strongest in the regions south of 50 deg N. (Carstea-USGS)
W70-01448

MICROELEMENTS IN THE WATER AND SUSPENDED SUBSTANCES OF RIVERS IN THE ASIATIC USSR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05A.
W70-01449

CONTENT OF INDIVIDUAL GROUPS OF ORGANIC SUBSTANCES IN THE WATERS OF SOME SOVIET IVERS,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05A.
W70-01450

BROMINE AND IODINE CONTENT IN THE WATER OF THE MAJOR RIVERS OF THE USSR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05A.
W70-01451

VARIATION IN TIME OF THE ISOTOPIC COMPOSITION OF THE SULFUR OF SULFATE IONS IN THE WATERS OF THE DON AND VOLGA RIVERS,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05A.
W70-01452

RARE AND DISPERSED ELEMENTS (MICROELEMENTS) IN THE WATER AND SUSPENDED SUBSTANCES OF RIVERS IN THE EUROPEAN USSR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
G. S. Konovalov, A. A. Ivanova, and T. Kh. Kolesnikova.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 94-111, 1967. Soviet Hydrology: Solected Papers No 5, p 520-533, 1967. 5 fig, 1 tab, 14 ref.

Descriptors: *Trace elements, *Elements (Chemicals), *Water chemistry, *Suspended load, Watersheds (Basins), Geomorphology, Water quality, Analytical techniques, Copper, Manganese, Cobalt, Dissolved solids.
Identifiers: *European USSR, Lead, Tin, Bismuth.

The contents of V, Mn, Co, Ni, Cu, Zn, Mo, Ag, Sn, Pb, and Bi in suspended and dissolved forms in the waters of the largest rivers in the European USSR depend on the chemical properties of the elements and the physiographic characteristics of river basins. No bismuth has been found in the water or in the suspended material. Lead, tin, silver, and cobalt were found only in suspended substances and only in some rivers. The other elements can be tentatively placed in the following order according to the increase in their dissolved form: V, Mn, Ni, Vn, and Cu. The ratios between the two main forms of the migration of microelements (in suspended substances and in dissolved form) differ considerably by river basin, especially if we compare the rivers of northern and southern basins and lowland and mountain rivers. Ni and Zn migrate not only with suspended substances, but also in dissolved form. (Carstea-USGS)
W70-01453

COMPOSITION OF ORGANIC SUBSTANCES IN FLOOD WATERS FORMING IN SMALL CATCHMENTS OF THE ARID ZONE,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
A. D. Semenov, L. I. Nemtseva, L. V. Brazhnikova, A. S. Demchenko, and A. P. Pashanova.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 52, p 186-190, 1967. Soviet Hydrology: Selected Papers No 5, p 554-557, 1967. 1 tab, 11 ref.

Descriptors: *Water chemistry, *Small watersheds, *Organic compounds, *Floodwater, Watersheds (Basins), Arid climates, Precipitation (Atmospheric), Soils, Organic matter, Amino acids, Proteins, Nitrates, Nitrites, Ammonium compounds, Sulfates, Dissolved solids, Carbohydrates.
Identifiers: Soil extracts, Soil water chemistry, Sugars.

Atmospheric precipitation and the nature of soils determine the composition of organic compounds in floodwaters of small catchments. Water samples were tested for organic carbon, amino acids, proteins, free reducing sugars, complex carbohydrates, amines, organic acids, complex esters, nitrites, nitrates, ammonium, and sulfates. Snow water and adjacent soil extracts were also analyzed. During flood periods, the amount of dissolved solids in water approached the value found in soil extracts. The amount of dissolved substances was highest in the first day of flood. The content of ammonium ions was higher in the snow water and soil extracts than in the floodwaters. The influence of atmospheric waters is more pronounced in the formation of organic substances in floodwaters than in the formation of inorganic substances. (Carstea-USGS)
W70-01454

HYDROCHEMICAL MAPS OF THE RIVERS OF KAZAKHSTAN AND THEIR USE FOR THE RAPID FORECASTING OF THE MINERALIZATION AND ION COMPOSITION OF WATERS OF PROSPECTIVE RESERVOIRS,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
I. M. Pavelko, and M. N. Tarasov.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 40-55, 1947. Soviet Hydrology: Selected Papers, No 5, p 495-508, 1967. 17 fig, 2 tab, 18 ref.

Descriptors: *Water management (Applied), *Water resources, *Water quality, Rivers, Forecasting, Ions, Water chemistry, Reservoirs, Maps.
Identifiers: *USSR, *Hydrochemical maps, Kazakhstan.

Maps of minimum, maximum, and weighted average mineralization of the water of rivers in Kazakhstan are compared. These maps, together with the relationships established between ion composition and mineralization, make it possible to judge the limiting values of the mineralization and chemical composition of the rivers of Kazakhstan in their annual cycle. A method is proposed which makes it possible, on the basis of the data obtained, to simplify the computations of the approximate mineralization and ion composition of waters of prospective reservoirs. (Carstea-USGS)
W70-01456

FORMATION AND STABILITY OF AL, FE, AND MG INTERLAYERS IN MONTMORILLONITE AND VERMICULITE,
Oregon State Univ., Corvallis.
Dumitru D. Carstea.
PhD Thesis, Oregon State Univ, June 1967. 117 p, 21 fig, 9 tab, 98 ref.

Descriptors: *Clay minerals, *Iron, *Aluminum, *Magnesium, *Analytical techniques, Montmorillonite, Mineralogy, Cation exchange, X-ray analysis, Acidity, Moisture uptake.
Identifiers: *Hydroxy-interlayers formation, Hydroxy-interlayers stability, Vermiculite.

The effects of pH and time on the formation of hydroxy-Al, Fe, and Mg interlayers were compared for montmorillonite and vermiculite. The stability of interlayers was evaluated by sequentially increasing the severity of dissolution treatments and by subjecting the interlayers to an HCl treatment. In montmorillonite, aluminum interlayers were formed at all pH levels. Systems equilibrated in acid media exhibited the greatest degree of interlayering. In vermiculite, aluminum interlayer formation was also greater for acid than for alkaline media. Changes after 6 months and one year were observed for both montmorillonite and vermiculite systems. Moderate amounts of iron interlayers were found in montmorillonite at all pH levels, whereas the alkaline environments favored their formation in vermiculite. Magnesium interlayers in montmorillonite and vermiculite were formed only in alkaline environments (pH greater than 10). The hydroxy-Al, Fe, and Mg interlayers in montmorillonite showed a higher degree of formation and exhibited a higher stability to sequential and HCl treatments than the interlayers formed in vermiculite.
W70-01457

FURTHER OBSERVATIONS OF HUMUS DECOMPOSITION AND NITRIFICATION,
East African Agriculture and Forestry Research Organisation, Kikuyu (Kenya).
H. F. Birch.
Plant and Soil, Vol 9, No 3, p 262-286, Sept 1959. 6 fig, 12 tab, 14 ref.

Descriptors: *Nitrification, *Decomposition, *Humus, Organic matter, Soil, Drying, Moisture, Soil chemistry, Nitrogen cycle, Nitrogen compounds, Gels, Soil surfaces, Boundaries (Surfaces), Cycling nutrients.
Identifiers: *Mineralization, Microbial activity, Organic gels, Solubilization, Surface effects, Microbial populations, Chemical processes.

After dry soil is moistened, a short period of rapid organic matter decomposition follows. Author investigated reasons for this phenomena and for mineralization of carbon and nitrogen during this period. Experimental evidence indicated that two processes of organic matter decomposition operate simultaneously: in one, only carbon mineralizes; in another both carbon and nitrogen mineralize. He shows that, after dry soil is moistened, considerable quantities of nitrogenous organic matter dissolve, and such solutions undergo rapid microbial decomposition, in which carbon mineralizes but nitrogen does not. Amounts of soluble organic matter were related directly to length of drying period. Concomitant nitrogen mineralization involves microbial decomposition of nonsoluble organic matter; rate of nitrogen mineralization is associated with surface area of organic gel in the soil. Author postulates that drying organic gels cause their fragmentation or increased porosity, leading to an increased surface area; moistening causes swelling and cohesion of gels, consequently decreasing their surface and eventually reducing rate of organic matter decomposition. Also, high rates of such decomposition following moistening of dry soil and rapid decline in decomposition rates may result from high microbial activity associated with youthful phases of developing microbial populations, followed by declining activity as such populations age. (Graetz-Wisconsin)
W70-01578

2L. Estuaries

HYDROGRAPHY OF THE BALTIC DEEP BASINS III,
Fishery Board of Sweden.
Stig H. Fonselius.
Fish Board of Sweden, Ser Hydrogr, Rep No 23, 1969. 97 p, 65 fig, 4 tab, 106 ref.

Descriptors: *Hydrography, *Estuaries, *Sea water, Mapping, Topography, Water chemistry, Gaging stations, Chemical analysis, Stagnant water, Oxygen, Hydrogen, Phosphates, Salinity, Water temperature, Density, Runoff, Rivers, Silicates, Nutrients, Water balance.
Identifiers: Baltic basins.

This monograph is a comprehensive study of the hydrography of the Baltic Sea with an emphasis on the stagnation taking place in its deep water basins. Samples of Baltic water were taken from established stations periodically from the beginning of the century. Some characteristics of the Baltic topography produce two water layers separated by a permanent halocline which impedes the mixing of the water layers. The data recorded at various Baltic stations indicate a gradual increase in the salinity and phosphorus content and a decrease in oxygen content of deep waters. Meteorological factors, the decreased runoff of the Baltic area rivers, and the decreased water exchange through the Danish sounds coupled with the increased intensity of the bottom currents in the Belts and Kattegat are responsible for these changes in salinity, oxygen, and phosphorus contents. The implication of the findings is that if there is a continuation of the trends toward increased salinity and phosphorus concentration in the Baltic, the sea's deep water shall soon become devoid of organic life. (Gabriel-USGS)
W70-01245

TRULLVATNET: A FLANDRIAN STRATIGRAPHICAL SITE NEAR MURCHISONFJORDEN, NORDAUSTLANDET, SPITSBERGEN,
Helsinki Univ. (Finland). Dept. of Geology and Paleontology.
For primary bibliographic entry see Field 02H.

W70-01253

MARINE RESEARCH, FISCAL YEAR 1968,
Smithsonian Institution, Washington, D.C. Science Information Exchange.
For primary bibliographic entry see Field 09D.
W70-01261

VIRGINIA BEACH EROSION COMMISSION.
For primary bibliographic entry see Field 06E.
W70-01322

ANALYSIS OF THE RELATIONSHIP BETWEEN ACOUSTIC REFLECTIVITY AND SEDIMENT POROSITY,
Lafayette Coll., Easton, Pa. Dept. of Geology; and General Dynamics Corp., Groton, Conn. Electric Boat Div.
For primary bibliographic entry see Field 02J.
W70-01428

A DEEP-SEA ELECTRICAL RESISTIVITY PROBE FOR MEASURING POROSITY AND DENSITY OF UNCONSOLIDATED SEDIMENTS,
SACLANT ASW Research Centre, La Spezia (Italy).
A. Kermabon, C. Gehin, and P. Blavier.
Geophysics, Vol 34, No 4, p 554-571, Aug 1969. 17 p, 16 fig, 9 ref.

Descriptors: *Electrical resistance, *Bottom sediments, *Instrumentation, Sediments, Oceanography, Electrical studies, Surveys, Exploration, Porosity, Density, Physical properties, Geophysics, Sampling.
Identifiers: Formation factor (Resistivity).

A study was made of the mass physical properties and electrical resistivity of marine sediments. The well-known linear correlation of density with porosity was confirmed. A third-degree polynomial curve was found to be the best fit for data relating porosity and the formation factor, which is the ratio of the bulk resistivity of marine sediments, to the resistivity of interstitial water. An electrical resistivity probe was devised to obtain in-situ profiles of resistivity versus depth. The instrument is 13 m long and weighs 700 kg in water. About 30 rapid measurements on the sea floor can be made in one lowering. Good correlation was obtained between electrical probe measurements and direct porosity measurements made on cores taken nearby. (Knapp-USGS)
W70-01429

ENERGY DISSIPATION IN A TIDAL ESTUARY,
Oregon State Univ., Corvallis. Dept. of Oceanography.
Jackson Blanton.
J Geophys Res, Vol 74, No 23, p 5460-5466, Oct 20, 1969. 7 p, 6 fig, 2 tab, 12 ref.

Descriptors: *Energy dissipation, *Tidal effects, *Estuaries, *Tidal energy, Oregon, Mapping, Water temperature, Salinity, Analysis, Mathematical studies, Water circulation, Energy transfer.
Identifiers: *Coos Bay (Ore), Tidal energy dissipation.

The extent and mechanism of the dissipation of tidal energy were investigated in Coos Bay, a coastal plain estuary located on the central Oregon coast. The study consisted in measuring and comparing the energy required to provide the observed mixing and an increase in potential energy with the energy lost through tidal damping. The measured dissipation rate in Coos Bay was 1/10,000 watt/kg. (Gabriel-USGS)
W70-01430

SEISMIC ATTENUATION OF GULF COAST SEDIMENTS,
Esso Production Research Co., Houston, Tex.
Frank N. Tullos, and Alton C. Reid.
Geophysics, Vol 34, No 4, p 516-528, Aug 1969. 13 p, 18 fig, 2 tab, 13 ref.

Descriptors: *Seismic studies, *Exploration, *Seismic properties, *Sediments, *Gulf Coastal Plain, Seismology, Stratigraphy, Data collections, Instrumentation, Systems analysis, Fourier analysis.
Identifiers: Seismic attenuation (Gulf Coast sediments).

Seismic attenuation values have now been obtained from normally layered Gulf Coast sediments. After normalizing with respect to the shot, the spectra of many traces over a small interval in depth can be averaged to minimize reflection interference and to yield a frequency response function associated with a given depth. Except for the measurements in the low velocity layer (LVL), a cemented array of geophones 1000 ft deep was used. The LVL measurements were made using individually cemented geophones. Data were taken on a digital recorder using a 0.5 ms sampling rate, and the processing was performed on a digital computer. Attenuation was found to vary exponentially with frequency to the first power in the range from 50 to 400 Hz. The 1000-ft section of earth, made up largely of clay and sand layers, was separated into 4 sections at depths of about 10, 100, and 500 ft. Attenuation in db/wavelength was found to be 13.1, 0.1508, 0.3641, and 0.2004 in the respective sections. (Knapp-USGS)
W70-01432

PHYSICAL PROPERTIES OF MARINE SEDIMENTS AS RELATED TO SEISMIC VELOCITIES,
Texas Instruments, Inc., Dallas.
Nabil Morgan.
Geophysics, Vol 34, No 4, p 529-545, Aug 1969. 17 p, 13 fig, 3 tab, 18 ref.

Descriptors: *Seismic studies, *Sediments, *Lake Erie, *Seismic properties, Density, Porosity, Particle size, Stratigraphy, Data collections, Statistical methods, Seismology.
Identifiers: Seismic velocity (Sediments).

An investigation of the dependence of seismic velocities on different physical properties of naturally occurring fresh-water sediments in Lake Erie has been conducted. Cores from one lake bottom were collected and the longitudinal seismic wave velocities as well as the physical properties (grain density, bulk density, porosity, median diameter, and phi deviation) were measured. The data were fitted with a second-order polynomial in all the physical properties to the seismic velocity. Independent variables were ranked according to their individual effect upon the sum of the squares of the regression residuals. A variance-analysis table was set up, and the coefficients were tested by a series of F ratios at certain probabilities. As porosity and bulk density are linearly related, these were not included together in the same model. There are strong indications that the porosity and its square together with the median diameter play a significant role in determining the seismic velocity at the probability of 0.90. At the higher probability of 0.99, the median diameter proved insignificant. The cubic term of porosity is insignificant at the 0.50 level. (Knapp-USGS)
W70-01433

OCEANOGRAPHIC PROFILING WITH IMPROVED VERTICAL RESOLUTION,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 07B.
W70-01445

PILOT STUDY OF ICE DRIFT IN THE GULF OF ST. LAWRENCE,
Massachusetts Inst. of Tech., Cambridge; McGill Univ., Montreal (Quebec). Marine Sciences Centre; and McGill Univ., Montreal (Quebec). Dept. of Physics.
For primary bibliographic entry see Field 02C.
W70-01446

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

FIRST VTE PILOT PLANT REPORT, JULY 1, 1967,
Oak Ridge National Lab., Tenn.
John W. Hill.
Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $1.25 per copy. Office Saline Water Res and Develop Progr Rep No 367, 1968. 61 p, 18 fig, 2 tab, 2 ref, 3 append. Agreement No 14-01-0001-534.

Descriptors: *Pilot plants, *Desalination plants, *Evaporators, *Evaporation, Fresh water, Sodium chloride, Films, Heat transfer, Sea water, Research and development.
Identifiers: *Oak Ridge National Laboratory, Office of Saline Water, Wrightsville Beach (NC), Rising film, Falling film.

The Oak Ridge National Laboratory tested a pilot plant which could evaporate a maximum of 20,000 gallons of water per day. Both the rising-film and falling-film modes of operation using fresh water and sodium chloride solutions were tested. Evaporator tubes with enhanced surfaces improved heat transfer coefficients. The plant was sent to the Office of Saline Water East Coast Engineering and Development Test Station, Wrightsville Beach, North Carolina for further testing with sea water. Test results, the plant equipment and the proposed test plan are described. (Carstea-USGS)
W70-01269

A HYDRODYNAMIC THEORY OF DESALINATION BY ELECTRODIALYSIS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
Ain A. Sonin, and Ronald F. Probstein.
Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.60 per copy. Office Saline Water Res and Develop Progr Rep No 375, Dec 1968. 60 p, 15 fig, 11 ref. Grant No 14-01-0001-1721 (OSW).

Descriptors: *Desalination, *Electrodialysis, Analytical techniques, Membranes, Laminar flow, Model studies, Brines, Diffusion, Density currents, Polarity, Demineralization.
Identifiers: Hydrodynamic theory, Dialysate concentration.

A hydrodynamic theory of demineralization by electrodialysis has been developed for a multichannel system with steady laminar flow between plane, parallel membranes. The modeling of the system is found to be governed by 4 basic similarity parameters: (1) a dimensionless applied potential, (2) the product of the channel aspect ratio and the inverse Peclet number, (3) the ratio of brine and dialysate inlet concentrations, and (4) a parameter measuring membrane resistance. For sufficiently long channels it is shown that there are 2 distinct regions: a 'developing' region where the concentration diffusion layers are growing, and a 'developed' region where the diffusion layers fill the channel. Parabolic and uniform velocity profiles are considered and self-consistent solutions are derived for the distributions of salt concentration, electric field and current density in the system, as well as for the total current. In the limits of low and high polarization analytic solutions are obtained which when matched at their point of equality closely approximate the complete numerical solutions. (Carstea-USGS)
W70-01270

DESALTING OF SEAWATER BY FREEZING,
Cornell Univ., Ithaca, N.Y.
H. F. Wiegandt, P. Harriott, and J. P. Leinroth.

Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.50 per copy. Office Saline Water Res and Develop Progr Rep No 376, Dec 1968. 43 p, 3 fig, 4 tab, 33 ref. Contract No 14-01-0001-1141.

Descriptors: *Desalination, *Desalination plants, *Freezing, *Sea water, Economics, Heat transfer, Brines, Condensation, Cost analysis, Water costs, Design.
Identifiers: *Secondary refrigerant freezing process, Butane, Multiple compressors.

The economics of the secondary refrigerant freezing process was evaluated with particular emphasis on large freezing plants. It was found that large economies resulted by using normal butane. The reasons for this are: (1) essentially all heat transfer is by direct contact of butane and water; (2) multiple compressors and module equipment are not required even at 50 mgd. Precooling the brine and condensing butane from the secondary compressor are additional contributing factors to the low water cost. A study of the secondary refrigerant freezing process using normal butane shows a water cost of 29 cents per 1000 gal for a single-train plant producing 50 mgd. The cost increases to 71 cents per 1000 gal for 5 mgd and to $1.76 per 1000 gal for 1 mgd, showing that the freezing process is most suitable for large rather than small or medium plants. (Carstea-USGS)
W70-01271

RESEARCH ON POROUS GLASS MEMBRANES FOR REVERSE OSMOSIS,
McDonnell Douglas Astronautics Co., Newport Beach, Calif.
F. E. Littman, and G. A. Guter.
Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.50 per copy. Office Saline Water Res and Develop Progr Rep No 379, Dec 1968. 44 p, 16 fig, 10 tab, 4 ref. Contract No 14-01-0001-1282.

Descriptors: *Membranes, *Reverse osmosis, *Desalination, Ureas, Nitrates, Phenols, Brines, Temperature, Pressure, Acidity, Heat, Membrane processes.
Identifiers: Porous glass membranes.

The use of porous glass as membrane material for reverse osmosis has been explored in an experimental study using the glass in the form of tublets. Porous glass prepared in this laboratory gave sodium chloride rejections as high as 97% from a 10,000 ppm salt feed. The variables in the process of porous glass fabrication were investigated and correlated with the reverse osmosis properties of the product glass. It has been demonstrated that porous glass membranes can reject a wide variety of materials to about the same extent as sodium chloride. These materials are urea, phenol, nitrates, borates, and magnesium salts. The effects of heat and surface treatment of the glass were studied as well as membrane thickness, brine temperature, pressure, and pH. This study demonstrates that porous glass membranes show considerable potential for use in the reverse osmosis process as a hollow fiber material where adequate fluxes can be realized. (Carstea-USGS)
W70-01272

HEAT-MASS TRANSFER TO PARTICLES SUSPENDED IN AGITATED LIQUIDS: 1. TRANSPORT BETWEEN LIQUIDS AND SPHERICAL PARTICLES IN A TANK,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 01B.
W70-01297

HEAT-MASS TRANSFER TO PARTICLES SUSPENDED IN AGITATED LIQUIDS: 2. EFFECTS OF TRANSPIRATION AND CHANGING DIAMETER TO SPHERES,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 01B.
W70-01298

PROPERTIES OF WATER AND AQUEOUS SOLUTIONS AT HIGH PRESSURES AND TEMPERATURES,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 01A.
W70-01299

OPERATION OF A 50,000 GPD PORTABLE REVERSE OSMOSIS PILOT PLANT,
Aerojet-General Corp., El Monte, Calif.
E. R. Watson.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $1.25. Office Saline Water Res and Develop Progr Rep No 430, May 1969. 63 p, 18 fig, 18 tab, 5 append. OSW Contract No 14-01-0001-930.

Descriptors: *Pilot plants, *Desalination plants, *Reverse osmosis, *Desalination, Membranes, Cellulose, Bacteria, Aqueous solutions, Chlorine, Research and development, Manganese.
Identifiers: *Cellulose acetate membrane, Formaldehyde.

Efforts were made to establish several major operational requirements for desalination pilot plants. Cellulose acetate membranes can be destroyed by certain types of bacteria, therefore, assembly must be done under sterile conditions. Treatment of the membrane stack assembly with about 2% aqueous solution of formaldehyde can prevent the bacterial damage. Manganese deposits form on the membrane surface when chlorine is used for bacterial protection. This precipitation occurred in water with a manganese content of 0.8-1.4 ppm. Stable operation of the pilot plant is feasible at an operating pressure as low as 450 psi. More research is needed to study the relationship between membrane size and pressure in order to achieve 50,000 gpd. (Carstea-USGS)
W70-01396

SEA WATER CORROSION TEST PROGRAM,
Dow Chemical Co., Freeport, Tex.
H. C. Behrens, F. D. Martin, O. Osborn, L. Rice, and W. B. Russell.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $1.25. Office Saline Water Res and Develop Progr Rep No 417, Mar 1969. 107 p, 30 fig, 6 tab, 20 ref, 3 append. OSW Contract No 14-01-0001-1090.

Descriptors: *Sea water, *Corrosion, *Alloys, *Copper, *Desalination processes, Dissolved oxygen, Acidity, Velocity, Temperature, Deaeration, Turbulence, Brines, Hydrogen sulfide, Magnesium hydroxide, Calcium carbonate.
Identifiers: *Sea water corrosion, Deaerators, Water refreshment rate.

The weight losses of 6 copper alloys tested for corrosion resistance in sea water were measured under different conditions of dissolved oxygen concentration, pH, temperature, velocity and water refreshment rate. The corrosion rate seems to be very highly correlated with oxygen concentration. Extremely low weight loss was noted under low dissolved oxygen conditions (less than 5 ppb). For this reason, every effort should be made in desalination plants to provide feedwater deaerators to keep the levels of oxygen below 5 ppb. At low oxygen levels, water velocity, water turbulence and temperatures in the range of 180-250 deg F had minor or no effects upon corrosion rates. At low oxygen levels, the pH of the feedwater should be as high as possible without promoting precipitation of Mg hydroxide or Ca carbonate. The effect of hydrogen sulfide in the heated water can be nullified through controlled oxygen additions. The quantities of brine recirculated should be held to a minimum if the dissolved oxygen is low. Corrosion monitors should be installed at critical locations throughout a plant. (Carstea-USGS)
W70-01397

DEVELOPMENT OF LOW PRESSURE REVERSE OSMOSIS MEMBRANES AND DESIGN OF A SMALL UNIT FOR BRACKISH WATER,
Dartmouth Coll., Hanover, N.H.
John L. Brock, Peter M. Fahey, Christian S. Miller, and D. Dean Spatz.
Research supported by contract by Office of Saline Water. Office Saline Water Res and Develop Progr Rep No 441, June 1969. 273 p, 75 fig, 9 tab, 62 ref. OSW Contract No 14-01-0001-1644.

Descriptors: *Desalination plants, *Reverse osmosis, *Membranes, *Brackish water, *Desalination, Potable water, Cellulose, Electron microscopy, Analytical techniques, Permeability, Research and development, Pressure, Design.
Identifiers: *Reverse osmosis membranes, Porous cellulose acetate membranes, Polyester filter paper, Home desalination appliances.

A household appliance which produces 3 to 5 gallons per day of potable water from brackish water is described. Its operation is based on reverse osmosis and the water pressure present in the household water system in the only required power source. A pilot system that extrudes the basic Sourirajan-Loeb membrane solution onto a continuous sheet of tough polyester filter paper produces reverse osmosis membranes. The characteristics of porous cellulose acetate membranes are reported for brackish water feed for low pressure. Direct experimentation and electron microscopy were used to study the membrane structure. (Carstea-USGS)
W70-01399

PROPERTIES OF SEA WATER AND SOLUTIONS CONTAINING SODIUM CHLORIDE, POTASSIUM CHLORIDE, SODIUM SULFATE AND MAGNESIUM SULFATE,
Monsanto Research Corp., Everett, Mass.
For primary bibliographic entry see Field 02K.
W70-01400

DEVELOPMENT OF NEW REVERSE OSMOSIS MEMBRANES FOR DESALINATION,
North Star Research and Development Inst., Minneapolis, Minn.
L. T. Rozelle, J. E. Cadotte, R. D. Corneliussen, and E. E. Erickson.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price 45 cents. Office Saline Water Res and Develop Progr Rep No 359, Oct 1968. 59 p, 19 fig, 8 tab, 19 ref, 4 append. OSW Contract No 14-01-0001-1143.

Descriptors: *Desalination processes, *Membrane processes, *Reverse osmosis, Membranes, Cellulose, Films, Analytical techniques, Electron microscopy, Anisotropy, Desalination.
Identifiers: *Ultrathin membranes, *Anistropic membranes, *Support membranes, Beta-glucan acetate, Cellulose acetate.

Ultrathin membranes, anistropic membranes, and support membranes for reverse osmosis were studied. Ultrathin membranes of Beta-glucan acetate were as effective as cellulose acetate (CA) in reverse osmosis desalination. Beta-glucan acetate has shown promise as a new polymer for anisotropic membranes. A polysulfone film was developed that has a greater potential as a support film for ultrathin membranes than the cellulose acetate film. Also polysulfone is more inert chemically than CA. This is important if in situ chemical and replacement techniques for ultrathin membranes are to be developed. An interferometry method was developed for directly measuring the thicknesses of ultrathin membranes. Electron microscopy studies indicated that Beta-glucan acetate had a wavy surface structure, and that the surface of CA was smooth with isolated fibrils. (Carstea-USGS)
W70-01401

THERMOPHYSICAL PROPERTIES OF SALINE WATER,
Monsanto Research Corp., Everett, Mass. Boston Labs.
Alexander Korosi, and Bela M. Fabuss.

Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $0.45, Office Saline Water Res and Develop Progr Rep No 363, Sept 1968, 53 p, 8 fig, 20 tab, 44 ref. OSW Contract No 14-01-0001-466.

Descriptors: *Thermal properties, *Physical properties, *Saline water, Thermodynamics, Thermal conductivity, Viscometers, Sea water, Sodium chloride, Instrumentation, Viscosity, Density, Potassium compounds, Sodium sulfate, Magnesium compounds, Temperatures, Electrolytes, Aqueous solutions.
Identifiers: Binary electrolyte systems, Ternary electrolyte systems, Multicomponent electrolyte systems, Glass capillary viscometers.

Thermal conductivity was measured in water, NaCl and sea water solutions in the temperature range of 25-150 deg C, using transient rather than steady state methods. The molalities of NaCl solutions were 0.7 and 3.5, and the solute concentration in the synthetic sea water corresponded to the ionic strength value of normal and three-fold concentrated sea water. Experimental viscosity and density measurements were made on electrolyte solutions containing one or two of the major sea water components, NaCl, KCl, sodium sulfate and Mg sulfate, dissolved in water. The viscosity of liquid water from 75 deg to 150 deg C was measured in a special glass capillary viscometer pressurized with hydrogen. The experimental results on binary, ternary and multicomponent electrolyte systems were correlated using Othmer's rule which establishes a linear relationship between the logarithm of viscosity of an aqueous solution and that of water at the same temperature. (Carstea-USGS)
W70-01402

NEUTRON INELASTIC SCATTERING STUDIES OF WATER AND IONIC SOLUTIONS,
Union Carbide Corp., Tuxedo, N.Y.
G J Safford, P S Leung, and P C Schaffer.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402. Office Saline Water Res and Develop Progr Rep No 372, Aug 1968, 69 p, 16 fig, 4 tab, 82 ref, 2 append. OSW Contract No 14-01-0001-372.

Descriptors: *Analytical techniques, *Water, *Aqueous solutions, Water properties, Salts, Hydrates, Ions, Molecular structure, Bonding, Desalination.
Identifiers: *Neutron inelastic scattering, Diffusion coefficient, Solid salt hydrates.

Slow neutron inelastic scattering was used to measure the intermolecular frequencies between 900 cm and 8 cm of water molecules in pure water and in aqueous solutions of La chloride, Ca chloride, Mg chloride, CsI, CsCl, KSCN, KI, KBr, KCl, KF, NaCl, Li nitrate and LiCl. The diffusion coefficients of water molecules in various aqueous solutions were also determined. Small or highly charged ions break existing water structure and form complexes with scattering bonds similar to those of water molecules in the corresponding solid salt hydrates. Salt solutions with larger charged ions also show new scattering bonds which, at lower temperatures, are broader and less pronounced than for smaller or highly charged ions. (Carstea-USGS)
W70-01403

ENERGY AS A FACTOR OF PLANNING IN THE FIELD OF SEA WATER DESALINATION INGENIEURGESELLSCHAFT FICHTNER, STUTTGART-FEUERBACH, GERMANY,
W. Fichtner.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 445-52 (1967). 2 fig. Paper No SWD 105.
Identifiers: *Energy costs, *Energy sources, Dual-purpose plant, Flash evaporation, Fossil fuels, Nuclear energy sources.

Emphasis is on the dual-purpose plant utilizing the multistage flash distillation method and energy supplied by steam power stations. A comparison of fossil fuel-fired plants vs nuclear-powered plants indicates that small desalination plants should utilize fossil fuel, whereas large plants should use nuclear power. Plant size should not solely determine the type of heat generation mechanism to be used. Other factors such as the relations between fuel heat costs and power selling costs, as well as alterations expected during the operating time of a plant should be taken into consideration. Characteristics of dual-purpose seawater distillation plants are given, as is a comparison of the economics of a nuclear power plant and a fossil fuel-fired plant for seawater distillation (17C MGD).
W70-01521

EVALUATION OF ALL POTENTIAL SOURCES OF ENERGY FOR DESALTING,
Ebasco Services, Inc., New York.
For primary bibliographic entry see Field 08C.
W70-01522

GAS TURBINES PROVE EFFECTIVE FOR DESALINATION,
Stal-Laval Turbine Co., Finspang, Sweden.
For primary bibliographic entry see Field 08C.
W70-01523

ORGANIC-COOLED HEAVY-WATER-MODERATED REACTORS – AN APPROACH TO LARGE-SCALE DUAL-PURPOSE PLANTS,
Atomics International, Canoga Park, Calif.
C Starr, S Golan, and D V Graf
Water Production Using Nuclear Energy, Ed by R G Post and R L Seale, p 253-72, 1966. 9 fig, 4 ref. Univ Arizona Press, Tucson. Proc Am Nucl Soc Symp, Mar 1966.
Identifiers: *Energy sources, *Heavy-water/organic-cooled reactors, *Nuclear energy sources, Converter reactors, Dual-purpose plant economics, Economic evaluations, Multistage flash distillation, Plant layout, Water costs estimate, 250 plus MGD plant.

Current light-water reactors are generally more attractive as energy sources than fossil plants in large plant sizes and low fuel cost nuclear heat sources such as the heavy-water reactor and fast breeder are of special interest for future large power and desalting applications. The HWOCR is particularly suitable because of a unique combination of design and operating characteristics. A layout is given for A 1-BGD, 3400-MWE (net) dual purpose plant that will utilize two 8250-MWT HWOCR units in parallel. Plant economics, performance characteristics, and a plant availability analysis are included. The steam developed by the nuclear heat source will power five 800-MWE back-pressure turbines exhausting steam at 25 PSIA to the brine heaters of ten 100-MGD multistage-flash evaporators. The total investment for such a plant is estimated at $1.05 billion. If the power can be sold at 2.0 mills/KWH, the product water cost will be about 13 cents/1000 gal.
W70-01524

FRESH WATER FROM NUCLEAR POWER WITH THE AGR AND SGHWR,
United Kingdom Atomic Energy Authority, Risley (England).
For primary bibliographic entry see Field 08C.
W70-01525

NUCLEAR REACTORS FOR SEA-WATER DESALINATION,
Iowa State Univ., Ames.

Presented at Am Soc Mech Engr Meeting, New York, Nov 27-Dec 1, 1966. Paper 66-WA-NE-21.
Identifiers: Applications of nuclear energy, Boiling-water reactors, Breeder reactors, Converter reactors, Dual-purpose plant, Economic evaluations, Energy costs, Pressurized-water reactors, Single-purpose plant, Water costs estimate.

Primarily on the basis of nuclear reactor principles and technology, current and near term converters and long range breeders for seawater desalination are analyzed. The trends of current and near term converters and the full utilization of uranium and thorium energy resources in developing fast and thermal breeders are discussed. Comparisons of single-purpose and multipurpose nuclear desalting plants from economic and technological considerations are also given. Water cost and steam cost are estimated for single-purpose and dual-purpose (with electric power credit of 3.65 mills/KWH) desalting plants at various reactor sizes up to 2400 MWT. Water costs were estimated to be about 30 cents/1000 gal for dual-purpose plants with 1600 MWT or larger reactors. Process steam from this size reactor was estimated at 30 cents/MBTU for a dual-purpose plant or 48 cents/MBTU for a single-purpose plant.
W70-01526

A FUEL CYCLE ECONOMIC ANALYSIS OF OXIDE FUELED POWER AND PROCESS HEAT PWR FOR SEAWATER DESALINATION,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 08C.
W70-01527

THE UNCLAD-METAL BREEDER REACTOR (UMBR) FOR DESALTING OR POWER,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 08C.
W70-01528

THE OPTIMAL DESIGN OF DESALINATION SYSTEMS,
Kansas State Univ., Manhattan.
L. T. Fan, C. Y. Cheng, L. E. Erickson, and C. L. Hwang.
2nd European Symp Fresh Water from Sea, Vol 4, Athens, May 1967. Desalination 3, 225-36, 1967. 14 fig, 17 ref.

Descriptors: *Economic evaluations, Design, Membrane processes, Flash distillation, Osmosis, Water costs estimate.
Identifiers: Multiple effect distillation.

Process analysis and optimization studies have been made for a multi-effect multistage flash distillation system and a multistage reverse osmosis system. In the distillation system, the heat supplied to the brine heater, the brine reject concentration, the recirculation rates within each effect, and the allocation of brine temperature and composition among the effects are controlled to arrive at an optimal policy. In the reverse osmosis process, multistage operation is compared with single-stage operation. The recirculation rates in each stage, the allocation of brine composition among the stages and the operating pressures in each stage are controlled to arrive at the optimal operating condition. A flow-work exchanger is incorporated into the reverse osmosis system and its quantitative advantages are examined under optimal conditions. A discrete form of the maximum principle in combination with other optimization techniques has been used for most of the optimization studies.
W70-01530

ECONOMIC EVALUATION OF DESALTING SUB-SYSTEM AS A PART OF THE TOTAL WATER SYSTEM,
California Univ., Los Angeles.
J. M. English, and N. El-Ramly.
Desalination 3, 308-17 (1967). 5 fig, 4 ref. Also preprints 2nd European Symp Fresh Water From Sea, Vol 4, Athens, May 1967.

Descriptors: *Economic evaluations, *Feasibility studies, Capital costs, Cost allocation, Water utilization.

Engineering and economic feasibility studies of projected desalination plants have been confined to single developments. The cost of desalted water is

compared with that of alternative supplies. A higher unit cost for water from a desalination plant as compared with other sources could be justified. The economics of desalination is considered from the viewpoint of the total water system of which the conversion plant may be only a component. The concept of limited planning horizon is discussed, and the water system is synthesized in relation to the long-term demand function. The alternative of a mix between the surface water collection systems and desalination is introduced. The optimum mix is determined on the basis of minimizing the present worth of costs in relation to demand. Through the use of continuous discounting (interest) and exponential approximations for the demand functions, the effects of the rate of return and rate of growth in demand on the optimum plant characteristics are shown in a direct, simple manner. With respect to individual water supplies, capital cost is allocated over the life of the plant in proportion to the demand pattern, and an equivalent marginal water pricing concept is formulated. This price is then minimized, and optimum life, investment and capacity are thereby determined.
W70-01531

SELECTION OF PARAMETERS OF AN ATOMIC ENERGY PLANT WITH HIGH PRODUCTIVITY DISTILLATION OF SEA WATER,
Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
L. S. Sterman, N. A. Mozharov, and V. V. Gubenko.
Desalination 5, 95-106 (1968). 5 fig, 4 ref. Also preprints 2nd European Symp Fresh Water From Sea, Vol 4, Athens, May 1967.

Descriptors: Capital costs, Dual-purpose plant, *Economic evaluations, *Nuclear desalination, Operating costs.
Identifiers: Pressurized-water reactors, 0-3000 MW (T) reactors.

Based on thermal economics, capital investment, and operational charges, the optimum parameters and power of an atomic power plant are selected. The method given for techno-economic analysis of nuclear energy plants of the PWR type generating electrical and heat energy allows one to choose the initial steam parameters at the turbine entrance, under different exhaust pressures. Techno-economic calculations for nuclear dual-purpose plants with reactor capacities of 760 MW (T) and coolant pressures in the first circuit equal to 100 ATM show that, for the same generation of electrical energy, minimum expenditures on heat given to the desalination plant correspond to a coolant temperature at the entrance to the reactor of 220 deg C with an exhaust pressure of 2 ATM. Increase in the thermal flux in the active zone (achieved by decreasing the marginal coefficient) leads to a marked decrease in specific calculated charges.
W70-01532

DUAL-PURPOSE NUCLEAR POWER AND DESALTING PLANTS,
Bechtel Corp., Los Angeles, Calif.
W. H. Wilson.
Water Production Using Nuclear Energy (Ed by R G Post and R L Seale), p 369-82, Univ. Arizona Press, Tucson (1966). 5 fig. (Proc Am Nucl Soc Symp, Mar 1966, Tucson).
Identifiers: *Dual-purpose plant economics, *Metropolitan water district, *Multistage flash distillation, *Siting surveys, Capitalized costs, Conceptual designs, Dual-purpose plant, Economic evaluations, Flash evaporation, Nuclear desalination, Water costs estimate, 51-250 MGD plant.

Background for and description of a 150-MGD, 1,600 MW (Net) dual-purpose plant to be used as a supplementary source of water and power for the metropolitan water district of southern California. A multi-stage flash distillation process was found most suitable, with a conceptual design consisting of three parallel 50-MGD plants. The cost of water was calculated for the desalting plants with top brine temperatures of 195-250 deg F, with the lowest cost water produced at a top brine temperature of 250 deg F. Capital costs for the dual-purpose plant, based on October 1965 wage and price levels, is $133,100,000, for the Bolsa Island site. A cost comparison between fossil- and nuclear-fueled plants shows that, based on an annual use of 75% natural gas and 25% fuel oil, at a cost of about 35 cents/mbtu desalted water from a fossil-fueled plant would cost 25% more to produce than that from a nuclear-fueled plant. The cost of water at the desalting plant was 21.9 cents/1000 gallons, with an extra five cents required to transport the water to the Diemer Filtration plant.
W70-01533

GUIDELINE FOR UNIFORM PRESENTATION OF DESALTING COST ESTIMATES.
Parsons (Ralph M.) Co., Los Angeles, Calif.

OSW R and D Progr rept no 264 (July 1967). 49 p, 3 fig.

Descriptors: *Economic evaluations, *Operating costs, *Water costs estimate, Capital costs, Cost allocation, Direct costs, Fixed costs, Indirect costs.

Guidelines and formats for computing and uniformly presenting estimated costs of desalted water by any process are provided. The method of cost centers has been selected for application to the economic analysis of desalting plants so that attention may be readily focused on basic elements of the complete plant. The costs are categorized into capital cost centers, recurring cost centers, and O and M cost centers. Examples of the format and a general outline for a report presenting the results of an economic analysis are given. Guidelines for preparation of the capital cost estimate meet the following objectives completeness, current costs, simplicity and uniformity of presentation, ease of evaluation and analysis, segregation of process equipment from site and service facilities, and adaptability to various methods of cost allocation in multipurpose plants. Each item to be included in the capital cost estimate is discussed in detail. To determine the cost of water, annual fixed and O and M costs are estimated to be the uniform average for the life of the plant. Each item in these cost categories is discussed separately. The cost of water is influenced by the method of desalting, the relation of the plant to its surroundings and other economic factors.
W70-01534

NUCLEAR DESALTING - FUTURE TRENDS, AND TODAYS COSTS,
Applied Research and Engineering Ltd., Durham (England).
R. Starmer, and F. Lowes.
Chem Eng 75 (19), 127-34 (1968). 9 fig, 9 ref.

Descriptors: *Flash distillation, *Reviews, Energy, Nuclear desalination, Nuclear energy, Water costs.

The total installed capacity of MSF plants throughout the world is rapidly increasing and should reach over 90 MGD by 1970. A target is for 1-BGD plants in 1980-90 producing water at 10-15 cents/1000 gal. The most important cost component of an MSF evaporator is the condenser tubing. Tubes of the longest practical length should be used (the limit appears to be 105 ft due to transportation difficulties). Optimizing evaporator performance depends greatly on the cost of steam. Large capacity plants offer a significant saving in capital cost per unit of product - about 40% saving would be expected when increasing the plant size from 5 to 50 MGD. Economics favor fossil fuels over nuclear for dual-purpose plants up to about 200 MGD. However, in special areas where fossil fuels are very cheap (say 5 cents/mbtu) they would have an advantage at even higher capacities. Reactor systems are being advanced and operating conditions improved. However, the largest single factor in reducing reactor cost is an increase in the size of the reactor unit. The trend must be toward a fast-breeder reactor system.
W70-01535

BRIDGING THE DESIGN-FABRICATION GAP IN THE CONSTRUCTION OF MAMMOTH DESALTING PLANTS,
Chicago Bridge and Iron Co., Ill.
A. N. Chirico, and T. R. Livingstone.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 773-87 (1967). 2 fig, 6 tab.

Descriptors: *Economic evaluations, Reviews, Water costs.
Identifiers: 0-50 MGD plant, 51-250 MGD plant.

There is no design-fabrication gap. Seawater can be converted to fresh water with present knowledge. There are 3 basic reasons why construction of large desalination plants is not occurring at an accelerated rate consistent with the needs (1) fear of obsolescence, (2) psychological cost barriers, and (3) apprehensiveness in size extrapolation. However, it is doubtful that the cost of desalted water can be reduced to less than 50 cents/1000 gal in 50-MGD plants within the next 20 years. A dual-purpose plant may lower water costs to 30 cents/1000 gal if the cost of fuel is not prohibitive. For this reason, nuclear fuel sources are now being considered for large conversion plants. There are tremendous capital and operating economies which reduce the cost of water drastically when dual-purpose technology is utilized. The only hope of reducing water cost to a level making it both commercially and domestically acceptable would be in integrating the production of power and water. It is obvious that procedures must be established to clearly differentiate and designate the responsibilities of government, designer-constructors, architect-engineers, utility companies, and the consumer.
W70-01536

A REPRESENTATIVE DESIGN OF NUCLEAR POWER/DESALTING PLANTS NOW AVAILABLE,
General Electric Co., San Jose, Calif; and Chicago Bridge and Iron Co., Oak Brook, Ill.
F. E. Crever, D. C. Maxwell, A. N. Chirico, and T. R. Livingstone.
Paper presented at Nuclex-66 Meeting, Basel, Switzerland, Sept 8-14, 1966. 51 p, 7 fig.

Descriptors: Brine heater leakage, Control systems, Cost allocation, Design, Water costs.
Identifiers0-3000 MW (T) reactors, 0-50 MGD plant, *Conceptual design, Brine heater leakage.

This report covers a conceptual design study of a nuclear dual-purpose electrical power-MSF distillation plant based on current technology. Design details normal to present-day reactors and water plants are not discussed. The plant capacity is 50 MGD and 300 MWE saleable. The heat source is a 1300 MWT BWR. Many design, control, and cost features peculiar to the dual-purpose concept are considered in detail. These features include water plant and brine heater construction, control of the brine heater pressure levels and the overall plant, and cost allocation between the power and water plants. Product water cost is estimated to be about 30 cents/1000 gal. The report includes detailed cost estimates, a computer printout of the water plant optimization study, a plant layout drawing, and a flow diagram including the reactor plant. An unusual feature is a discussion and analysis of brine heater leakage problems. This section includes a tabulation by isotope of the radioactive constituents in typical BWR condensate.
W70-01537

QUESTIONS OF SEA WATER DESALINATION PLANT DESIGN,
W. Fichtner.
Presented at 2nd European Symp Fresh Water From Sea, Vol 4, Athens, May 1967. Desalination 3, 252-58 (1967). 4 fig.

Identifiers: *Dual-purpose plant economics, *Economic evaluations, Boiling-water reactors, Coupling (Reactor-desalting plant), Fossil fuels, Fuel costs, Nuclear desalination, Product ratio, Water costs estimate, 0-50 MGD plant.

A comparison is presented of product ratio and water cost for full backpressure 50-MGD dual-purpose desalination plants with light water nuclear power stations (approximately 65 ATM saturated steam) vs fossil-fueled power stations (approximately 180 ATM 540/540 deg C). The seawater maximum temperature is 110 deg C (230 deg F). The specific heat consumption (performance ratio) of the desalination plant is varied from 40 to 120 mcal/cu.m. The power cost is determined by assuming a market value for power of 5.0 to 7.5 mills/kwhr. The results show that the product ratio (kwh/cu.m.) for the nuclear power station is approximately 60% that of the fossil fuel power station under equivalent conditions. Also, for nuclear fuel costs of 0.70 $/gcal and fossil fuel costs of 1.50 $/gcal the product water costs are approximately equivalent. Results are presented for fossil fuel costs of 1.25, 15.0 and 1.75 $/gcal.
W70-01538

U.S.-MEXICO-IAEA STUDY OF LARGE NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHERN MEXICO,
Office of Saline Water, Washington, D.C.
J. A. Hunter.
Paper SM-113/38 presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 20 p, 10 fig.
Identifiers: *Dual-purpose plant, *Feasibility study, *Mexico, *Southwest United States, Agriculture, Capitalized costs, Economic evaluations, Energy sources, Liquid-metal fast-breeder reactors, Multistage flash distillation, Nuclear desalination, Nuclear energy sources, OSW sponsored, Siting surveys, Vertical tube evaporators, Water costs estimate, Water utilization, 3000 plus MW (T) reactors.

Results of a study by a joint IAEA-U.S.-Mexico team to determine the technical and economic practicability of a dual-purpose nuclear-powered plant to supply water and power for the region comprising the southwest U.S. and Northern Mexico. The team determined that a plant sufficient to meet 1980 water needs should be of 1 bgd capacity with two light water reactors of 5000 MW (T) each, producing 2000 MW of electricity. Advanced plant technology assumed for 1990 includes use of liquid metal fast breeder reactors and vertical tube evaporators coupled with multistage flash for brine heating. Capital and annual cost data were developed for three possible sites - Tiito, San Luis, and Santa Clara areas, using interest rates of 4%, 6%, 8%, and 10%, with 30-year life assumed for dual-purpose plant and 50-year life for civil works associated with water conveyance and power transmission. For 1980 plant, water costs range from 16 to 40 cents/1000 gal, with power costs from 1.8 mills to 3.1 mills/kwhr. For 1990 plant, water cost estimates range from 9 to 31 cents/1000 gal, while power costs vary from 1.1 mills/kwhr at 4% fixed charge range to about 2.5 mills/kwhr at 10% fixed charge rate.
W70-01539

NUCLEAR POWER AND WATER DESALTING PLANTS FOR SOUTHWEST UNITED STATES AND NORTHWEST MEXICO.
International Atomic Energy Agency, Vienna (Austria).

Report TID-24767 (Sept 1968). 377 p, 83 tab, 69 fig.
Identifiers: *Dual-purpose plant, *Feasibility study, *Mexico, *Southwest United States, Agriculture, Capitalized costs, Economic evaluations, Energy sources, Liquid-metal fast-breeder reactors, Multistage flash distillation, Nuclear desalination, Nuclear energy sources, Siting surveys, Vertical tube evaporators, Water costs estimate, Water utilization, 3000 plus MW (T) reactors.

A preliminary assessment conducted by a joint United States, Mexico, and IAEA study team. The team concluded that dual-purpose nuclear plants are a technically feasible method of supplying freshwater and electricity to the states of Mexico and U.S. that border the lower Colorado River. Such plants could provide the required quantities of water and could enhance the quality of water in the region. The initial plant studied produce 1 bgd of water and 1700 mwe saleable power. Based on 1966-67 prices, the project would cost from $8,500,000 to $1 billion as the fixed charge rate changes from 4% to 10%. Water costs at the distribution center would vary from 15.5 to 33 cents/1000 gal for the lowest cost location depending upon fixed charge rates to 17 to 40 cents/1000 gal for the greatest cost location. Electricity costs would vary from 1.8 mills/kwh at 4% fcr 3.1 mills/kwh at 10% fcr. The preliminary economic assessment leads the study team to recommend that further detailed studies be conducted to firmly establish the economic practicability of such plants. Summary is available as report TID-24681.
W70-01540

TRENDS IN DESALINATION.

Nucl Eng 13, 854-58 (1968). 12 fig, 3 tab.

Descriptors: *Nuclear desalination, *Reviews, Distillation processes, Dual-purpose plant economics, Energy costs, Energy sources, Water costs estimate.

A short review of 13 different methods being used or considered for the provision of fresh water supplies from salt or brackish water together with a survey of lines of development, project proposals, and cost studies. From a review of various cost studies it would appear that a nuclear-powered dual-purpose desalting plant would produce the lowest cost water. Calculated costs range from 24 to 54 cents/1000 gal of product water.
W70-01541

WATER DESALTING COST - PRESENT AND FUTURE,
International Atomic Energy Agency, Vienna (Austria).
D. B. Brice.
In Isotope and Radiation Techniques in Soil Physics and Irrigation Studies, p 403-21, (Proc Symp, Istanbul, June 12-16, 1967), Intern At Energy Agency, Vienna (1967). 6 fig, 11 ref.
Identifiers: *Distillation processes, *Nuclear energy sources, *Water costs estimate, Breeder reactors, Dual-purpose plant, Dual-purpose plant economics, Economic evaluations, Energy sources, Multistage flash distillation, Nuclear desalination, Reviews, Vertical tube evaporators.

Some of the more promising processes for desalting, such as multistage flash distillation and long tube vertical evaporation, are described. Electrodialysis is normally used for brackish water. A MSF plant requires a thermal energy input of 50,000 or more kcal/cu.m. A substantial reduction in the cost of water would be realized if an inexpensive source of energy such as nuclear energy were available. By the end of 1966 nuclear reactors in operation had a total capacity of 9000 MW (E). This should increase to 35,000 MW (E) by 1970 and 100,000 MW (E) by 1975. Improvements are expected to bring the cost of steam 18 cents/mbtu by mid-1970s, to 12-15 cents with advanced converters in the late 1970s and to 6-10 cents with breeder reactors by the early 1980s. Scale formation limits the temperature usable in a MSF plant, whereas electric power costs are lowest when steam is produced at high temperatures. Thus the advantage in dual-purpose plants. The water-to-power ratio in dual-purpose plants is limited at present to 0.8-0.8 mgd/MW (E), depending on the type of reactor. Projected water cost estimates are as low as 23 cents/1000 gal and further into the future perhaps 11 cents/1000 gal.
W70-01542

FACTORS INVOLVED IN THE ECONOMIC PRODUCTION OF USABLE FRESH WATER FROM SALINE SOURCES,
Powell (Sheppard T.) and Associates, Baltimore, Md.
S. T. Powell.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 429-44 (1967). 4 fig, 5 tab. (Paper SWD/100).
Identifiers: *Economic evaluations, *Waste disposal, Brine system designs, By-product economics, Corrosion, Corrosion control, Fixed costs.

Removal of oil detergents, insecticides, miscellaneous organic compounds (the most serious contaminants in coastal waters), and saline supplies which contain iron (above 0.5 ppm) will raise the cost of the finished water. The use of steel pipe in saline well construction (design life of well 20 yrs) is being considered because of its availability, initial cost, and the ease of construction. However, steel well castings equipped with slotted screens have a limited life in brackish formations (as low as 2 yrs in some instances). This rapid deterioration has been due to screen plugging and general fouling by corrosion from the water or from the corrosive properties of the formation in which wells have been located. Corrosion can be minimized by using insulating couplings (nonmetallic castings). Brine disposal (20,000 tons per day for a system of 150-MGD capacity) is very costly for inland plants but is not considered a major cost problem for coastal sites. It does create a thermal pollution problem. Total costs for brine disposal for plants (15 to 50 MGD) vary from 1.8 to 3.2 million dollars, depending on plant size. Water costs may be less if magnesium, bromine, fluoride or other products can be converted from the brine disposal.
W70-01545

COASTAL DESERTS - PRIME CUSTOMERS OF DESALINATION,
International Geographical Union, Wayland, Mass.
P. Meigs.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 721-36 (1967). 2 fig, 1 tab, 11 ref. (Paper SWD/85).
Identifiers: *Site selection criteria, *Water utilization, Agriculture, Geography.

Much of the information given is from a study entitled the geography of coastal deserts (Paris, UNESCO). Methods of heat generation discussed are solar radiation and oil deposit utilization for small desalination plants. Advantages of coastal desalination plants are (1) availability of unlimited supplies of seawater which can be pumped to the desalination plant at less cost than inland brackish or saline water, (2) convenient discharge of residual brine directly into the ocean, (3) cheap ocean transportation of equipment and fuel, and (4) food provided from the seawater.
W70-01546

MINERAL BY-PRODUCTS FROM THE SEA,
Grace (W. R.) and Co., Clarksville, Md.
M. L. Salutsky, M. G. Dunseth, and O. B. Waters, Jr.
OSW R and D Progr Rept No 91, PB-181 588 (1964). 130 p, 17 fig, 81 tab, 27 ref.
Identifiers: *By-product manufacturing processes, *Chemical by-products, *Feedwater treatment, *Fertilizer, By-product economics, Chemical production, Ion exchanging, Removal from feedwater, Calcium, Scale prevention.

Experimental investigations were carried out toward the recovery of potassium, calcium, magnesium boron, and other elements from seawater. Means for significantly improving the recovery of potassium were found. However, at the present state of development a potassium fertilizer from this source would cost 2 to 3 times more than from conventional sources. The best method found for the removal of calcium was a modification of classical lime-soda process. This would remove up to 90% of the calcium from seawater at a cost of

out 18.8 cents/1000 gal. In other studies it was und that a slurry of superphosphate fertilizer in awater can be converted to a solution of sodium osphate by continuous ion exchange, that the mmonia requirements in a descaling process could en be reduced by about one-third, and that the osphate recovery from a continuous ion change contactor is 97-99%. Three methods ere explored for the recovery of boron from sea-ater, distillation as trimethyl borate, coprecipita-n with magnesium hydroxide, and adsorption on eformed magnesium hydroxide. The latter two ethods may be valuable for the recovery of boron ecause of their simplicity. Two methods were ex-ored for the concentration of a mixture of metal-c elements, concentration on magnesium am-onium phosphate and adsorption on magnesium ydroxide.
70-01548

HE PRODUCTION OF AMMONIUM NITRATE ERTILIZER BY USING LOW-COST ENERGY ROM A NUCLEAR DESALINATION REAC-OR,
ak Ridge National Lab., Tenn.
or primary bibliographic entry see Field 03F.
70-01549

RECIPITATION OF SULFATE SALTS FROM ALINE SOLUTIONS,
race (W. R.) and Co., Clarksville, Md.
Block, and O. B. Waters, Jr.
SW R and D Progr Rept No 305 (Jan 1968). 59 p, 6 fig, 34 tab, 17 ref.
dentifiers: *By-product manufacturing processes, Physical properties, *Precipitation, Brine concen-ation ratio, Chemical by-products, Chemical roduction, Economic evaluations, OSW spon-ored, Waste disposal, Wastes.

n experimental investigation of the solid and quid phases in the system calcium sulfate - sodium ulfate - water. Measurements were made in the emperature range 25 to 100 deg C and with sodi-m chloride concentrations from 0 to 4.0 molal. hase and solubility diagrams are given for the vari-us conditions. A preliminary economic evaluation as made on a sodium sulfate recovery process ased on a 3-to-1 seawater brine concentrated urther to 10-to-1 by solar evaporation. The reac-on was run at 70 deg C. At the current price level f sodium sulfate, this process was found to be neconomical.
70-01550

A CLOSED-CYCLE PROCESS FOR PREVENT-NG SCALE FORMATION IN EVAPORATORS ND PRODUCING INDUSTRIAL CHEMICALS T A NUCLEAR DESALINATION PLANT,
Oak Ridge National Lab., Tenn.
. E. Blanco, W. C. Yee, W. E. Clark, J. M. Holmes, and R. Salmon.
Report ORNL-4057 (Sep 1967). 51 p, 12 fig, 42 ef.
dentifiers: *Chemical production, *Feedwater reatment, *Fertilizer, *Scale prevention, lowsheets, Multipurpose plant, Scaling.

Caustic and sodium carbonate are added to sea-ater to precipitate greater than 95% of the calci-m as calcium carbonate at ph 9.2. After removal f the precipitate, the ph is decreased to 7 by ad-ing hydrochloric acid to permit evaporation (to a x concentration) at 350 to 400 deg F without cale formation. Caustic, chlorine, and hydrogen re produced from concentrated seawater in a con-entional industrial electrolytic cell. The calcium arbonate is calcined to produce sodium carbonate or further descaling. Hydrochloric acid for ph ad-ustment is produced by the combination of 6% of he hydrogen and chlorine. An optional feature is he production of fertilzier either (1) by combining lectrolytic hydrogen and nitrogen from air iquefaction to produce ammonia or (2) by com-ining this ammonia with excess carbon dioxide rom calcined calcium carbonate to produce urea. An economic evaluation based on the production of 1 bgd of fresh water showed that a private company could detain revenue from the sale of excess chlorine and hydrogen and could provide the descaling service for a fee of 1 cent/1000 gal.
W70-01551

RECOVERY OF SALTS FROM SALINE WATERS VIA SOLVENT EXTRACTION,
Dow Chemical Co., Walnut Creek, Calif.
R. R. Grinstead, and J. C. Davis.
OSW R and D Progr Rept No 320, Jan 1968. 118 p, 28 fig, 45 ref.
Identifiers: *Chemical by-products, *Feedwater treatment, *Waste disposal, By-product manufacturing processes, Chemical production, Experimental data, OSW sponsored, Removal from feedwater, Magnesium, Solvent extraction.

The results of a study of the chemistry of mixed ionic extractant systems and their possible application to the recovery of by-products from desalination brines. In water-toluene systems, amines exhibit a wide spread in apparent base strength, which has been shown to be mainly a result of differences in tendency of the amine salts to aggregate in toluene. The order of increasing extraction of simple inorganic anions by these systems is nitrate, bromide, chloride, bicarbonate. Extraction studies are reported with mixed ionic systems, consisting of alkylammonium carboxylates, which extract both components of an inorganic salt. The same order of preference for anions is observed as for amines alone. The order of decreasing extraction of cations is calcium, magnesium, sodium, potassium.
W70-01552

MINERALS FROM SEA SALT,
Yale Univ., New Haven, Conn.
J. A. Tallmade, J. B. Butt, and J. S. Herman.
Ind Eng Chem 56 (7), 44-65, 1964. 3 fig, 332 ref.
Identifiers: *By-product economics, *Chemical by-products, Bibliographies, By-product manufacturing processes, Chemical production, Fertilizer, Literature surveys, Reviews, Seawater chemical analysis.

A comprehensive review and evaluation of methods of recovering minerals from the large quantities of concentrated brines and salt mixtures resulting from desalination. Such recovery is a possible means of income to reduce the cost of fresh water from a desalting system. Specific processes are classified as those pertaining to recovery of halogens, major metals (Sodium, Magnesium, Calcium, and Potassium), and minor and trace elements. Processes are also designated as to whether mixed salts or multiple products are involved. All the elements are present in some measure in the salts from the sea. Some 39 presently considered worth recovering range from chlorine with a concentration of 18,980 ppm to gold at 0.000006 ppm. Separation methods reviewed include precipitation, electrolysis, electrodialysis, adsorption, ion exchange, chelation, oxidation, chlorination, solvent extraction, and solar evaporation.
W70-01553

THE SEA AS A SOURCE OF DISSOLVED CHEMICALS,
Dow Chemical Co., Freeport, Tex.
W. F. McIlhenny, and D. A. Ballard.
In selected papers on desalination and ocean technology, ed by SN Levine, Dover Pub, Inc, New York, 1968. p 1-15, 2 tab, 35 ref. Also preprint AM Chem Soc Meeting, Los Angeles, Apr 1963.
Identifiers: *By-product economics, *Chemical by-products, By-product manufacturing processes, Chemical production, Literature surveys, Reviews, Seawater chemical analysis.

From the dissolved salts (166 million tons/cu mi) in seawater, only common salt, sodium and potassium compounds, calcium and magnesium compounds, magnesium metal, and bromine have been produced in commercial quantities. In search of profitable methods of producing other minerals and metals, Dow studied a hypothetical factory processing 2 million acre-ft of seawater annually. Some 50 dissolved chemicals ranging in amounts from 54 million tons of sodium to less than 0.02 tons of gold would pass through the factory each year. Annual operating costs of $12 million derived for a chemical separation plant alone (or $3 million for a plant operating in conjunction with a saline water conversion plant) proved prohibitive. It was concluded that production of not one of the 35 elements below the concentration of those presently produced commercially, or any combination of them, would be profitable. Many elements (iron, copper, aluminum, zinc, lead, tin, nickel, manganese, and mercury) greatly diluted in seawater are concentrated several hundredfold or thousandfold by various species of marine plants or animals. Improvement of technology of culturing, nurturing, and harvesting these marine organisms may present a solution. Use of ion exchange beds, ionic membranes, and selective electrodialysis may prove profitable.
W70-01554

AGRICULTURAL WATER BY NUCLEAR DESALINATION AND TECHNICAL ROUTES TO ITS ACHIEVEMENT,
Oak Ridge National Lab., Tenn.
R. P. Hammond.
Water Production Using Nuclear Energy, Univ Arizona Press, Tucson. (Proc AM Nuclear Soc Symp). Ed. by R. G. Post and R. L. Sealey, p 337-58, Mar 1966. 7 fig, 11 ref.
Identifiers: *Agriculture, *Water utilization, Economic evaluations, Nuclear desalination, Reviews, Water costs estimate.

An analysis is made of cost components of large-scale seawater desalting to show where we stand using presently available reactors and evaporator technology and the areas where improvements must be made to achieve various levels of agricultural water cost. Water at $65/acre-foot is within reach of present technology, but no large-scale agricultural use is anticipated until the price can be brought down to the $45-$30 range. Solution of this problem requires (1) development of one or more approaches to a single-purpose plant (or one producing only a little power), (2) rapid development of low-cost, high-performance evaporators, (3) development of nuclear reactors which can supply energy at much lower cost than present reactors, and (4) experimental and prototype plants which can be scaled up to sizes far larger than would ever be needed for city water sources.
W70-01557

TECHNOLOGY NEEDED FOR THE ECONOMIC USE OF DESALTED WATER IN AGRICULTURE,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03F.
W70-01559

PROGRESS ON THE DESIGN OF MULTIFLASH EVAPORATORS,
Weir Westgarth Ltd., Glasgow (Scotland).
J. M. Stewart, and W. R. Querns.
Desalination 3, 139-46, 1967. 4 fig. Presented at 2nd European Symp Fresh Water from Sea, Vol 8, Athens, May 1967.
Identifiers: *Multistage flash distillation, *Reviews, Component designs, Component development, Design, Evaporators, Layout, Product water purity.

Recent progress in the design of multiflash evaporators is outlined with particular reference to improvements in performance and efficient use of materials. Cost reduction and efficiency are expected to advance gradually through development of existing ideas, rather than because of any sudden major breakthrough. One possibility to be guarded against is that, because of keen worldwide competition, designers might resort to cost cutting

procedures detrimental to both customer and the science. Also discussed are the chemical problems of desalting by flash evaporators. Solutions are examined, with possible avenues for additional study suggested. As part of a large experimental program in the United Kingdom, Weir Westgarth Ltd. in association with the Ukaea has built at troon on the Ayrshire coast of Scotland a large research and development station which will accommodate very large modules for brine flow tests, as well as smaller, more sophisticated plants for corrosion and scale prevention tests. The multiflash system is expected to be the leading method of desalination until at least 1980-85.
W70-01565

THERMODYNAMIC PROPERTIES OF SEA-WATER AND ITS CONCENTRATES,
Monsanto Research Corp., Everett, Mass.
For primary bibliographic entry see Field 01A.
W70-01566

SOME PHYSICAL PROPERTIES OF SEA WATER IN VARIOUS CONCENTRATIONS,
National Engineering Laboratory, East Kilbride (Scotland).
For primary bibliographic entry see Field 01A.
W70-01568

PITTING OF TITANIUM ALLOYS IN SALINE WATERS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 08G.
W70-01569

RESEARCH ON CORROSION MECHANISMS IN SALINE WATER, USING REVERSIBLE AND IRREVERSIBLE ELECTRODES,
Battelle Memorial Inst., Columbus, Ohio.
For primary bibliographic entry see Field 08G.
W70-01571

PROPERTIES OF SEA WATERS AND ITS CONCENTRATES UP TO 200 DEG C,
California Univ., San Diego, La Jolla.
For primary bibliographic entry see Field 01A.
W70-01572

INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE - 3,
AEC, Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 10.
W70-01573

3B. Water Yield Improvement

POTABLE WATER EXTRACTED FROM THE AIR - REPORT ON LABORATORY EXPERIMENTS,
Royal Inst. of Tech., Stockholm (Sweden). Dept. of Hydraulics.
B. Hellstrom.
J Hydrol, Vol 9, No 1, p 1-19, Sept 1969. 19 p, 12 fig, 1 tab, 2 ref.

Descriptors: *Water supply, *Condensation, *Air conditioning, *Humidity, *Separation techniques, Water vapor, Condensers, Thermodynamics.
Identifiers: Water extraction (Humid air).

Experiments to extract water from the air were carried out in the laboratory by means of a commercial air-conditioning plant (dehumidifying unit). Air was drawn through the unit by a fan, and the amount of water produced was collected, measured, and analyzed. The feasibility of this method was fully proved by the experiments. The extracted water might be expensive, but the method is intended as an alternative in those places where water is very costly or only very small quantities are required. (Knapp-USGS)
W70-01246

STATISTICAL EVALUATIONS OF A CLOUD-SEEDING PROGRAM AT THE STREAMFLOW CONTROL LEVEL,
Washington State Univ., Pullman. Coll. of Economics and Business; and Washington Water Research Center, Pullman.
Millard Hastay, and John S. Gladwell.
J Hydrol, Vol 9, No 2, p 117-135, Oct 1969. 19 p, 2 fig, 8 tab, 9 ref.

Descriptors: *Cloud seeding, *Evaluation, *Washington, Statistical methods, Forecasting, Streamflow forecasting, Regression analysis, Least squares method.
Identifiers: Cloud seeding evaluation, Skagit River (Wash).

During the winters of 1962-63 and 1963-64 cloud-seeding operations were undertaken on the Skagit River (Washington) watershed. Conditions required that the statistical evaluation be made at the streamflow control level. A combination of least squares regression with principal components analysis is developed. This requires preliminary screening of variables using a liberal (0.01 level of significance) critical region, followed by the orthogonalization procedure of principal components. Final stepwise regression analysis using the principal component scores and the 0.05 level of significance follows. Tests are consistent with treating the residuals as Gaussian, homoscedastic, and non-autocorrelated. The analysis is replicated in various ways. Without exception, the excess of actual over predicted flows for the full period of the experiment was significant at 0.01 'or higher' level. However, whereas the excess in 1964 is invariably significant at the 0.005 'or higher' level, the 1963 excess would not be judged significant by itself at the 0.05 level. This is explained by a five-fold increase in seeding between 1963 and 1964. Two years subsequent to the period of seeding are analyzed: observed flows fail to show significant deviations from expected flows. Estimates indicate at least 15% runoff increase from seeding. (Knapp-USGS)
W70-01247

WATER SUPPLY IN COLD REGIONS,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02C.
W70-01259

COMBINED WEATHER AND VEGETATION MODIFICATION PROMISES SYNERGISTIC STREAMFLOW RESPONSE,
Washington State Univ., Pullman. Coll. of Agriculture.
Donald R. Satterlund.
J Hydrol, Vol 9, No 2, p 155-166, Oct 1969. 12 p, 2 tab, 15 ref.

Descriptors: *Cloud seeding, *Watershed management, *Water yield improvement, Rainfall-runoff relationships, Evapotranspiration, Runoff, Hydrogeology, Water yield.
Identifiers: Synergistic effects.

The potential effect of simultaneous application of cloud seeding and vegetation modification of target watersheds was tested using Thornthwaite water balance models. Combining practices often produces a synergistic interaction that increases runoff from treated woodland watersheds over the sum of the two practices applied separately. The synergistic gain appeared in 29 of 30 tests, using climatic data from wooded areas of the United States. Increased runoff attributable to synergistic interaction ranged from 0 to 43 mm annually, with quantities exceeding 25 mm annually appearing commonly from wooded regions of the dry Southwest. The validity of the tests and significance of the results are discussed, with the conclusion that water-short nations cannot afford to overlook this potential for increasing their water supply. (Knapp-USGS)
W70-01264

THE DEFINITION OF THE TERMS HYDROLOGICALLY ARID AND HUMID FOR AUSTRALIA,
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 07A.
W70-01267

3C. Use of Water of Impaired Quality

NATURAL CONTAMINATION HAZARDS IN ARID BASINS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-01485

MINERALIZED SPRINGS AND THEIR EFFECT ON UTAH'S WATER SUPPLIES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W70-01486

WATER COST IN DEVELOPING COUNTRIES,
J. Barnea.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 3, 737-52 (1967). 5 ref.
Identifiers: *Water costs estimate, *Water utilization, Siting surveys.

Surveys by UN experts show that the bulk of water consumed in developing countries is used for irrigated agriculture. Normally, groundwater is cheaper than desalinated water, and nonagricultural sectors of an economy can afford higher water costs. Blending and mixing of desalinated water with brackish water can improve the quality of the brackish water, increase the quantity of water, and, in effect, reduce the cost of the desalinated water. A UN survey shows that in Madras State (India) the use of 1000 imperial gallons of water for rice cultivation yields a gross agricultural income of $0.05. Construction of a dam will provide water in the Manabi province of Ecuador on the Portoviejo River for $0.011/1000 gal, on the Calceta River for $0.03/1000 gal. The average costs of groundwater are given as being from $0.01 to $0.10/1000 gal.
W70-01544

A CONCEPTUAL NUCLEAR ENERGY CENTER FOR THE CO-PRODUCTION OF AGRICULTURAL CHEMICALS AND DESALTED WATER TO SERVE A PILOT FOOD FACTORY,
Department of the Interior, Washington, D.C.
S. A. Bresler, and E. F. Miller.
Preprint SM-113/24 of Paper Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 18 p, 8 fig, 7 ref.
Identifiers: *Agriculture, *Economic evaluations, *Water utilization, Capitalized costs, Chemical by-products, Chemical production, Conceptual designs, Cost breakdowns, Electrochemonuclear systems, Energy costs, Feasibility study, Multipurpose plant, Agro-industrial complexes.

Results of a study of a thermodynamically balanced water-ammonia complex. A flowsheet is presented with charts summarizing the preliminary cost estimates and unit costs for each primary product as determined by the available energy method of cost allocation given in IAEA tech. rept. ser. no. 80. Outlined is a method of adjusting the flowsheet to larger scaled operations, i.e., in giant food factories, to achieve a better ammonia-agricultural water balance through the addition of facilities for the parallel production of steam, electric power and synthetic motor fuel. High pressure steam or electric power could be used to increase the production of water by utilizing a vapor compression recycle in conjunction with a multistage flash plant. Additional electric power could be used on site for the production of phosphoric acid and mixed fertilizers. Conclusions are that it would be feasible to construct and operate a pilot food facto-

y of the kind described using presently available uclear and chemical engineering technology.
V70-01556

DESALTING SALINE IRRIGATION WATER SUPPLIES FOR AGRICULTURE - A CASE STUDY, LOWER COLORADO RIVER BASIN, U.S.A.,
Bureau of Reclamation, Denver Colo.; and Office of Saline Water, Washington, D.C.
. T. Maletic, E. S. Krous, and M. S. Sach.
Preprint SM-113/37 of paper presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 18 p, 12 ref.
dentifiers: *Agriculture, *Land utilization, *Multistage flash distillation, *Water utilization, Electrodialysis process, Feedwater treatment.

A case study involving 10,570 irrigable acres near Yuma, Arizona, was performed to evaluate potential applications of multistage flash distillation (MSF) and electrodialysis (ED) processes to desalting water for agriculture. Costs and benefits of desalting water at concentrations of 2600 and 5330 ppm to concentrations of 1500, 900, and 400 ppm were determined. Benefits result from shifts to more profitable cropping patterns, increasing crop yields, reducing water use, reducing costs for water application and drainage, and increasing the flow of farm products from the project. Costs are based on project features such as desalting plants and steam generating equipment, raw water collection facilities, storage reservoirs, conveyance and distribution system, brine disposal system, blending facilities (MSF only), Gypsum addition system (ED only), and water treatment facilities. Benefit-cost ratios based on yield projections to year 1990 were negligible with water of 5330 ppm desalted to 1500 ppm, but this increases to 1.62 with desalting to the 400 ppm level. Benefit-cost ratios varied from negligible at 1500 ppm to 1.72 at 400 ppm when the feedwater source was 2600 ppm. Investment costs were high, ranging from $5000 to $8200/acre. Desalting is expected to be important in the future of agriculture, but competition with other water development possibilities will be involved.
W70-01561

3E. Conservation in Industry

NUCLEAR ENERGY CENTERS - INDUSTRIAL AND AGRO-INDUSTRIAL COMPLEXES,
Oak Ridge National Lab., Tenn.
J. W. Michel.
Preprint SM-113/32 of Paper Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 37 p, 21 ref, 13 fig.
dentifiers: *Agriculture, *Agro-industrial complexes, Breeder reactors, Cost breakdowns, Economic evaluations, Energy costs, Energy sources, Evaporators, Nuclear energy sources, Water utilization.

Results of a 1967 study at ORNL to determine the technical and economic feasibility of nuclear-powered industrial and agro-industrial complexes. Basic information was developed on the cost of producing industrial products requiring significant amounts of electricity and of producing a variety of basic food corps. The general economics of combining a nuclear-electric generating station, an industrial complex, and a large agricultural enterprise into an agro-industrial complex was evaluated for both near-term and far-term technologies for the nuclear desalting plant. The effects on the economic return of size, changes in product mix and sales price levels, and of operation with bypass steam to reduce the generation of electricity were also determined. Five typical coastal desert locales in India, Sinai, Baja, California, Peru, and western Australia were briefly examined to test the adaptability of this concept to real world conditions.
W70-01560

MINING AND WATER CONSERVATION.

Pa Stat Ann Tit 52, secs 1406.2, 1406.5 (Supp 1969).

Descriptors: *Pennsylvania, *Mining, *Surface waters, *Water conservation, Legislation, Legal aspects, Water supply, Drainage, Permits, Coal mines, Administrative agencies, Bodies of water, Rivers, Streams, Coals, Surface drainage.

The purposes of this act are: (1) the protection of the health, safety, and general welfare of the people by providing for the conservation of surface land areas which may be affected by bituminous coal mining; (2) the enhancement of land values; (3) the preservation of surface water drainage and public water supplies; and (4) generally the improvement of the use and enjoyment of lands. Part of the application to the Department of Mines and Mineral Industries for the operation of a mine consists of a map or plan which must include, in addition to other specified information, the locations of all bodies of water, rivers, and streams in proximity to the proposed operation. (Keith-Florida)
W70-01570

3F. Conservation in Agriculture

SALT BALANCE AND CRITICAL DEPTHS OF GROUND WATERS OF THE PART OF THE VAKH VALLEY UNDER IRRIGATION FOR MANY YEARS (RUSSIAN),
Yu. G. Planin.
Izvestiya Akad Nauk, Tadzhik, SSR, Otdeleniye Fiziko-Matematicheskikh i Geologo-Khimicheskikh Nauk, No 2 (28), p 83-95, 1968. 9 tab, 7 ref.

Descriptors: *Irrigation, *Salt balance, *Leaching, *River basins, Salinity, Infiltration, Precipitation (Atmospheric), Irrigation effects, Reclamation, Water quality, Geology, Drainage, Water source, Water chemistry, Calcium, Sodium, Magnesium, Sulfates, Temperature, Humidity, Vegetation, Evapotranspiration.
Identifiers: *USSR, Vakh River irrigated basin.

The principles of reclamation of long-term irrigated lands were investigated on the basis of hydrologic, geologic, and atmospheric data recorded in a selected 156-ga-area of the Vakh basin, USSR, 1960 to 1963. Loss of salt is associated with drainage waters and this loss exceeds the amount of salt brought by irrigation waters. Chloride, sodium and magnesium sulfate are the most actively leached elements. The smallest loss is shown by gypsum and calcium carbonates. The cause of both positive and negative salt exchange is poor stability of the salt regime. In general, a zone of relatively active salt exchange must be not less than 15 to 20 inches thick. Empirical formulas were used for the determination of critical depths. (Gabriel-USGS)
W70-01447

AUTOMATION OF SURFACE IRRIGATION SYSTEMS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
Howard R. Haise, and E. Gordon Kruse.
'Automation of Irrigation and Drainage Systems.' Proceedings National Irrigation and Drainage Spec Conf, ASCE, Phoenix, Ariz p 175-200, Nov 13-16, 1968. 13 fig, 9 ref.

Descriptors: *Surface irrigation, *Turnout gates, *Laterals, Automatic control, Water distribution.
Identifiers: *Fluidic diverters, *Water-powered cylinders, *Center pivot gates, Float valves.

Two systems for automating surface irrigation are described. One uses pneumatic valves remotely controlled by tone telemetry to open and close turnouts at timed intervals. The other uses water-powered cylinders activated by float valves to operate center pivot gates. Large fluidic diverters have also been evaluated for irrigation applications. The automation components can be adapted to furrow, border dike, and basin irrigated fields supplied by open ditches or buried pipelines. Several field systems have been installed and evaluated.
W70-01481

AUTOMATION OF SURFACE IRRIGATION WITH FLUIDIC DIVERTERS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
E. G. Kruse, P. A. Freeman, and H. R. Haise.
Presented at annual meeting of the ASAE, Purdue Univ, Lafayette, Ind, June 22-25, 1969; to be published in Trans of the ASAE.

Descriptors: *Electronic sensing, *Control components, *Mechanical gate structures, Siphons.
Identifiers: *Fluidic technology, *Fluidic diverters, *Throat dimensions, *Controlled fluid, Bowles Engr'g Corp, Distribution structures.

Fluidic technology has been developed within the past 10 years. Fluidic devices control the flow of fluids using no moving parts and often utilize the energy of the flowing fluid as a source of power for control of the devices. Fluidic devices are easily interfaced with mechanical or electronic components of a control system. In irrigation applications, a large fluidic element can be used to divert the irrigation stream from conveyance to distribution structures and back, using either fluid or electronic sensing and control components. In other applications, smaller fluidic elements may perform the control function, with the weight or pressure of the controlled fluid being used to actuate mechanical gate structures. Experimental fluidic diverters developed by the Bowles Engineering Corp., Silver Springs, Md., with throat dimensions ranging from 1/4 x 1/4 inch up to 8 x 8 inches appeared to have application in automation of surface irrigation systems. This paper describes the results of a cooperative study, laboratory and field, to evaluate feasibility of utilizing large or small fluidic diverters to switch irrigation streams directly or in conjunction with mechanical gates or siphons.
W70-01482

THE PRODUCTION OF AMMONIUM NITRATE FERTILIZER BY USING LOW-COST ENERGY FROM A NUCLEAR DESALINATION REACTOR,
Oak Ridge National Lab., Tenn.
J. M. Holmes, R. Salmon, R. E. Blanco, and J. W. Ullmann.
Report ORNL-TM-2202 (Apr 30, 1968). 20 p, 4 fig, 31 ref.
Identifiers: *Chemical production, *Multipurpose plant, By-product economics, By-product manufacturing processes, Chemical by-products, Energy sources, Fertilizer, Flowsheets.

The cost of producing ammonium nitrate was estimated and compared with that for the conventional steam-methane process. Hydrogen was produced by the electrolysis of water with advanced-type cells and power costs varying from 1 to 3 mills/kwhr. Nitric acid, ammonia, and ammonium nitrate were produced with the hydrogen by conventional methods. The capital cost of the nitric acid plant was reduced by about 8% by using oxygen from the electrolysis plant instead of air. Nitrogen for the ammonia plant was recovered from the nitric acid tail gas. The results showed that ammonium nitrate produced in a 698-ton/day plant using power at 1.6 mills/kwhr could compete with the product from a conventional reforming plant using 31 cent/mbtu natural gas. If oxygen credit is allowed, electrolysis would compete with plants using 20 cents/mbtu natural gas. At larger plant sizes, the comparison is less favorable to the electrolytic process, because of its poorer scaling factor. At 2330 tons/day of ammonium nitrate, 1.6 mills/kwhr electricity competes with 34.5 cents natural gas, assuming no oxygen credit. The

average U.S. industrial gas price in 1963 was about 34 cents/mbtu.
W70-01549

AGRICULTURAL WATER BY NUCLEAR DESALINATION AND TECHNICAL ROUTES TO ITS ACHIEVEMENT,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W70-01557

TECHNOLOGY NEEDED FOR THE ECONOMIC USE OF DESALTED WATER IN AGRICULTURE,
Oak Ridge National Lab., Tenn.
R. P. Hammond, and T. D. Anderson.
Preprint SM-113/27 of paper presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 12 p, 2 fig.
Identifiers: *Agriculture, *Water utilization, Agro-industrial complexes, Breeder reactors, Economic evaluations, Energy costs, Energy sources, Evaporators, Heat transfer improvements, Nuclear energy sources.

A summary of the present economic position of desalting in agriculture and of technological developments of nuclear reactors, desalting plants, and crop production which are necessary to improve this position, for reactors, two important factors will affect future energy costs - the advent of very large units and the arrival of advanced breeders. The economic consequences and probable timing of each of these are discussed. For seawater evaporation equipment, the importance of enhanced heat transfer surface and large size plants on economics is emphasized, and recent developments in this direction are summarized. In agricultural technology, controlled production conditions may be expected to provide an environment in which new inputs of crop breeding, nutrient control, and efficient water application may result in outputs per unit of water used far beyond present productions.
W70-01559

DESALTING SALINE IRRIGATION WATER SUPPLIES FOR AGRICULTURE - A CASE STUDY, LOWER COLORADO RIVER BASIN, U.S.A.,
Bureau of Reclamation, Denver Colo.; and Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 03C.
W70-01561

PROCEDURES FOR ESTIMATING IRRIGATION WATER REQUIREMENTS,
Bureau of Reclamation, Denver, Colo.
Don Robb.
Preprint of Papers Presented at Intern Hydrol Symp, Sept 1967, Fort Collins, Colo. 8 p, 2 fig, 5 ref.
Identifiers: *Agriculture, *Water utilization, Agronomy, Ground water recharge, Soil structure.

Part of a study to develop better procedures for estimating the various factors which comprise the total irrigation water requirement - crop consumptive use, effective precipitation, distribution losses, surface runoff, and deep percolation. Preliminary data show that the most common cause of lower than optimum irrigation efficiencies, after differences of soil type, slope, and climate have been eliminated, is lack of sufficient information on the part of the irrigator about when to apply water and how much to put on. Farm efficiencies have a great effect on water projects. For example, a change from 50% to 60% farm irrigation efficiency would result in a 17% reduction in water requirement for the area or a 20% increase in the area which sould be served. This does not take into account any downstream reuse of return flow, but it points out that in some areas improved efficience of use of present water supplies may be more attractive in terms of costs and benefits than development of new supplies.
W70-01562

FACTORS AFFECTING THE ABILITY OF AGRICULTURE TO PAY IRRIGATION-WATER COSTS,
Food and Agriculture Organization of the United Nations, Rome (Italy).
M. A. Hagood.
In Isotope and Radiation Techniques in Soil Physics and Irrigation Studies, p 423-7, (Proc Symp, Istanbul, June 12-16, 1967), Intern at Energy Agency, Vienna 1967. 6 fig, 11 ref.
Identifiers: *Agriculture, *Water utilization, Land utilization, Water costs estimate.

There are no universally acceptable standard criteria for determining how much agriculture can pay for irrigation water. Justification of cost will depend upon the countrys need to develop its soil and water resources for food, for international trade, and for its cumulative effect on other industries in comparison with other possible uses and their overall contributions to the economy. Social and political conditions often have as much or more influence on development cost decisions than do strictly economic analyses. Many studies indicate that 10 cents/1000 gal is an upper limit of acceptable costs for developing irrigation water at present economic levels. Under private development and on projects where water users must pay total water costs, methods are available for making feasibility budgets based on present prices. Because of inflation, world food shortage, recessions, future population and other unknown factors, it is hazardous to predict how much farmers or agriculture can pay for irrigation water. Better utilization of water available now offers opportunities for developing sources at costs much less than those for sources such as seawater conversion.
W70-01563

SOIL AND WATER CONSERVATION.
For primary bibliographic entry see Field 04D.
W70-01602

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

FLOOD PLAIN INFORMATION, GLACIER CREEK, GIRDWOOD, ALASKA.
Army Corps of Engineers, Anchorage, Alaska.

Corps Eng Flood Plain Rep, Aug 1969. 28 p, 6 fig, 10 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Alaska, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Girdwood (Alaska), Standard project flood, Intermediate regional flood.

Flooding of Glacier Creek, Girdwood, Alaska is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01249

FLOOD PLAIN INFORMATION, KAAAWA, OAHU, HAWAII.
Corps of Engineers, Honolulu, Hawaii.

Corps Eng Flood Plain Rep, Aug 1969. 25 p, 7 fig, 9 plate.

Descriptors: *Floods, *Flood damage, *Hawaii, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Kaaawa (Hawaii), Standard project flood, Intermediate regional flood.

Flooding of Kaaawa, Oahu, Hawaii is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01251

FLOOD PLAIN INFORMATION, MORGANTON, NORTH CAROLINA: VOLUME 1. HUNTING CREEK AND TRIBUTARIES.
Corps of Engineers, Charleston, S.C.

Corps Eng Flood Plain Rep, July 1969. 57 p, 18 fig, 11 plate, 17 tab.

Descriptors: *Floods, *Flood damage, *North Carolina, Flood plains, Flood control, Nonstructural alternatives, Maximum probable flood, Historic flood.
Identifiers: Morganton (NC), Standard project flood, Intermediate regional flood.

Flooding of Hunting Creek, Morganton, North Carolina is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01252

STUDIES OF THE INTERNAL DRAINAGE OF GLACIERS,
Uppsala Univ. (Sweden). Dept. of Physical Geography.
For primary bibliographic entry see Field 02C.
W70-01255

GEOPHYSICAL STUDIES OF WATER LEAKAGES FROM RESERVOIRS,
Moscow State Univ. (USSR). Dept. of Geology.
A. A. Ogilvy, M. A. Ayed, and V. A. Bogoslovsky.
Pap presented at 13th Meeting of European Ass of Explor Geophysicists, Salzburg, June 1968. Geophysical Prospecting, Vol 17, No 1, p 36-62, Mar 1969. 27 p, 10 fig, 7 ref.

Descriptors: *Water loss, *Reservoir leakage, *Geophysics, Ice, Boreholes, Electrical equipment, Sands, Electrolytes, Water temperature, Resistivity, Currents (Water), Filtration, Dams, Damsites, Mathematical studies, Porosity, Electrical studies.
Identifiers: *USSR, Armenia, Uzbekistan.

Because geophysical methods offer good prospects for the indentification of leakage from water reservoirs, laboratory studies and observations at reservoir sites located in Armenia and Uzbekistan, USSR, were conducted. The electrical prospecting method for leakage detection is based on the possibility of using natural currents which form electric fields in passing through porous media. Observations at reservoir sites were made by moving non-polarizable potential electrodes and water velocity measuring devices. The combination of natural

current method and benthonic flow rate measurements is effective in determining water leakage from reservoirs. In some cases it is useful to supplement these methods by temperature measurements within the whole reservoir profile. (Gabriel-USGS)
W70-01257

COMBINED WEATHER AND VEGETATION MODIFICATION PROMISES SYNERGISTIC STREAMFLOW RESPONSE,
Washington State Univ., Pullman. Coll. of Agriculture.
For primary bibliographic entry see Field 03B.
W70-01264

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01301

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01302

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01303

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 8-9, p 33-38, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Alteration of flow, *Riparian rights, *Reasonable use, *Indirect benefits, Natural flow doctrine, Riparian land, Water rights, Competing uses, Relative rights, Benefits, Public benefits, Prior appropriation, Legal aspects, Riparian land.
Identifiers: Non-riparian benefits, Harmful use.

Proposed section 429-1 would allow a riparian owner who has the privilege of effecting a harmful alteration of a waterbody under section k to affect the alteration to further the use of non-riparian land instead, as long as it was no more harmful than for the use of riparian land. This section would aid in the optimum development of land and water resources, while protecting the rights of co-riparians. This addition is needed to counter the common law rule that any use on non-riparian land that is harmful to riparians is unlawful. Constitutional attacks suggesting that the section destroys the cause of action a riparian has against a non-riparian user are not substantial since the harm would be limited to that allowed for riparian use. In effect, the risk of harm would not be increased over that previously allowed for harmless uses. (Douberley-Florida)
W70-01304

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01305

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01306

STATE PARTICIPATION IN FEDERAL NAVIGATION AND FLOOD CONTROL PROJECTS.

R I Gen Laws Ann secs 46-2-1, 46-2-2, 46-2-7 thru 46-2-9, 46-2-12, 46-2-13, 46-2-19 (1956).

Descriptors: *Rhode Island, *Flood control, *Administrative agencies, Navigation, Federal government, State governments, Government finance, Contracts, Eminent domain, Condemnation, Damages, Compensation, Cities, Relocation, Riparian rights, Political aspects, Legislation, Local governments, Legal aspects.
Identifiers: Grants of power.

The Director of Public Works may apply to Congress for federal funds for state harbor improvements. The director, cities, and towns may negotiate and enter into agreements with the federal government for participation in federal navigation and flood control projects. Agreements must be approved by the governor. Pursuant to such projects, cities and town may: (1) acquire by condemnation any land, easements, and rights-of-way required; (2) expend funds for such improvements and acquisitions; and (3) issue bonds to fund such projects. Cities and towns voting to cooperate with the state and federal government in flood control projects may acquire land and rights by eminent domain and may construct or relocate highways, bridges, sewers, power and communication lines, railroad tracks, dams, and pumping stations as necessary. Damages to the rights of riparian owners for tidewater land taken under this act must be awarded as for any other property right. (McDonough-Florida)
W70-01326

DRAINAGE--CONDEMNATION FOR DRAINAGE SYSTEMS.

Va Code Ann sec 15.1-283 (1964).

Descriptors: *Virginia, *Drainage systems, *Local governments, *Eminent domain, Drainage, Drainage program, Buildings, Structures, Appropriation, Costs, Public health, Public benefits, Public utilities.

The governing body of any county, city, or town shall have power to provide for adequate drainage of all areas in the county, city, or town. It may install and maintain drainage systems, acquire lands, buildings, structures, or any interest therein, and appropriate money therefor. Such governing body is vested with the power of eminent domain to the extent necessary for such acquisitions. (Smith-Florida)
W70-01332

SUBDIVISION ORDINANCES FOR DRAINAGE AND FLOOD CONTROL.
Va Code Ann sec 15.1-466 (1964).

Descriptors: *Virginia, *Drainage systems, *Flood control, *Sewers, Local governments, Drainage, Drainage programs, Regulation, Control, Management, Governments, Storms, Sanitary engineering, Legislation, Right-of-way, Light, Air, Public health, Public benefits, Public utilities, Cities.

A subdivision ordinance may include reasonable regulations and provisions that apply to: (1) plat details; (2) orderly development of the general area; (3) coordination of streets and drainage; (4) drainage and flood control, light and air, and other public purposes; (5) water, storm, sanitary sewer, and other utilities; (6) any right-of-way for public use, any street, curb, gutter, sidewalk, drainage or sewer system or other improvement. (Smith-Florida)
W70-01333

DRAINAGE NETWORK ANALYSIS WITH K-BAND RADAR IMAGERY,
Kentucky Univ., Lexington. Dept. of Geography.
For primary bibliographic entry see Field 07A.
W70-01427

CONSERVANCY.

Minn Stat secs 111.01 thru 111.82 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Drainage districts, *Drainage systems, *Flood control, Water levels, Vegetation, Drainage, Drainage programs, Water policy, Public health, Environmental sanitation, Water rights, Riparian rights, Costs, Control, Conservation, Governments, Water law, Legislation, Cities, Judicial decisions, Municipal water, Water control, Flood protection, Administrative agencies.

DRAINAGE, FLOOD CONTROL, AND THE CONTROL OF THE USE OF DRAINAGE SYSTEMS IN THE INTEREST OF SANITATION AND PUBLIC HEALTH ARE CLEARLY WITHIN THE FUNCTIONS OF GOVERNMENTAL ACTION. Therefore, the power is granted to the courts to grant petitions for the organization and establishment of districts for drainage and conservancy. Rights and duties of involved landowners are outlined, including provisions for the payment of costs and expenses of such district. Procedural requirements for organizing districts are established, and a board of directors is given the powers necessary to carry out the district's functions. Owners of land abutting upon any body of water are given the power to initiate proceedings to establish a uniform water level, persuant to outlined procedures. Municipalities are given the power to take steps necessary to control or destroy harmful or undesirable aquatic vegetation or organisms in public waters. The policy of the state is declared to be to promote the retention and conservation of all precipitated water in the area in which such precipitation falls. (Smith-Florida)
W70-01585

CONSERVANCY.
Minn Stat secs 111.01-111.20 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Drainage districts, *Reclamation, *Flood control, Drainage programs, Drainage, Water policy, Public health, Environmental sanitation, Water rights, Riparian rights, Costs, Control, Conservation, Governments, Water law, Legislation, Cities, Judicial decisions, Municipal water, Water control, Flood protection, Regulation, Streams, Rivers, River training, Irrigation, Surveys, Reservoirs, Reservoir construction, Gages, Rain gages, Stream gages, Warning systems.

The district court of any county in this state is vested with jurisdiction to establish drainage and conservancy districts for the purpose of: (1) regulating watercourses and the flow of water by altering such watercourses; (2) reclaiming or otherwise protecting lands subject to overflow; (3) irrigation;

(4) prevention of fires; (5) control of flood waters; and (6) providing for sanitation and public health. A petition for the formation of such a district must be signed by at least twenty-five percent of the resident freeholders of the district. Upon the granting of a petition the court appoints a board of directors to determine the need for such a district. The board and its employees may enter upon any lands to make surveys and examinations. Upon the filing of a petition by the board of directors, the district court is empowered to effect the drainage, reclamation, irrigation, or protection of land by issuing the necessary orders and decrees. The board may petition for the creation of reservoirs, water-power plants to be financed by the issuance of bonds, and the temporary removal of bridges. The board may establish and maintain stream and rain gauges and a flood-warning service. (Smith-Florida)
W70-01586

CONSERVANCY.
Minn Stat secs 111.21-111.42 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Riparian rights, *Costs, *Permits, Domestic water, Municipal water, Cost sharing, Cost allocation, Cost-benefit ratio, Repairing, Maintenance, Drainage, Drainage systems, Drainage programs, Water policy, Flood control, Flood protection, Public health, Water rights, Control, Conservation, Governments, Legislation, Cities, Assessments, Usufructuary rights.

Landowners rights to the use of the waters of the district for any purpose shall continue as they existed at the time of the organization of the district. Where improvements made by the district make possible a greater or better use of the waters, the right to such greater use is the property of the district. Such rights may be leased or assigned in return for reasonable compensation. Parties desiring to use the waters of the district must make application to the board, and preference is given to domestic and municipal uses. Expenses are paid out of the general funds of the counties involved in proportion to the benefits received, and each county auditor in turn assesses the property benefited in proportion to the benefit received. The board of directors may levy upon the property benefited such sum as the court may authorize for upkeep and repair of the district. Districts already established may acquire the right to operate under this chapter. The board of directors has full control and authority over all contracts of the district. (Smith-Florida)
W70-01587

CONSERVANCY.
Minn Stat, secs 111.65-111.82 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Water levels, *Vegetation, *Appraisals, Taxes, Water policy, Public health, Environmental sanitation, Water rights, Riparian rights, Costs, Cost allocation, Cost sharing, Conservation, Legislation, Governments, Cities, Municipal water, Domestic water, Benefits, Damages, Control, Assessments.

A majority of the owners of property abutting upon any body of water may initiate proceedings to establish a uniform water level by filing a petition with the district court. Three resident freeholders must be appointed as appraisers to ascertain the damages and benefits that will result. The court may revise, correct, amend, or confirm assessments made by the appraisers, and the amount of benefits assessed against each tract of land is a first lien thereon. The governing body of any city or town may expend funds for the control or destruction of harmful or undesirable aquatic vegetation or organisms in public waters. Such governing body may levy a special tax for such purposes. (Smith-Florida)
W70-01588

WATERS: SURFACE WATER DRAINAGE,
Robin F. Worthington.
U Fla L Rev, vol 2, no 3, p 392-402, Fall 1949, 11 p, 75 ref.

Descriptors: *Legal aspects, *Florida, *Water, *Water law, Civil law, Water rights, Surface runoff, Surface waters, Flood control, Ditches, Flooding, Judicial decisions, Water balance, Routing, Drainage, Drainage systems, Watercourses, Artificial watercourses, Developed waters, Water resources, Natural streams, Non-perennial streams, Perennial streams, Drainage programs, Water policy, Watershed management, Watersheds (Basins).

The disposition and control of surface water between precipitation and collection within defined water courses is discussed. The use of non-surface water is generally governed by the reasonable use doctrine. However, the general law of surface waters is a combination of the reasonable use doctrine, the civil-law rule, which prohibits interference with the natural flow of surface water to the extent that the enjoyment of another's land is disturbed, and the common-enemy or common-law rule which treats water falling on land as a common enemy with which any proprietor has an unlimited and unrestricted legal right to deal as he pleases not withstanding harm resulting to his neighbors. Surface water is defined in Florida as water, regardless of its origin, that drains without any distinct or well-defined channel. A proprietor owns and has an absolute right to surface water on his land. No one may complain if ordinary flow injures his property. However, one may not cause more than normal flow to enter adjoining lands. Florida does not follow either of the traditional doctrines, but rather decides tort liability upon the facts of each case. (Darragh-Florida)
W70-01592

SEA WALLS AND HIGHWAY PROTECTION.
Miss Code Ann secs 8497 thru 8500 (1956).

Descriptors: *Mississippi, *Diversion structures, *Tidal waters, *Highways, Financing, Costs, Construction costs, Bulkheads, Breakwaters, Barriers, Check structures, Dikes, Roads, Road construction, Cost analysis, Culverts, Legislation, Legal aspects, Sluices, Floodgates, Storms, Federal government, Projects.

The term 'sea wall' includes filling behind the wall, culverts, sluiceways, flood gates, and any other construction work found necessary for the protection of the water from storms, caving banks, and overflow. Each county board of supervisors may erect and maintain seawalls, breakwaters, bulkheads, shore stabilization structures, causeways, bridges, breakwaters, or other necessary improvements to protect public roads which extend along beach or shore lines of tidewaters and which are exposed to damage by water driven ashore by storms. The boards may issue bonds to finance the construction of protective structures and for the improvement or strengthening of exposed roads and highways. The boards must make preliminary plans, specifications, and estimates of construction costs and obtain federal approval with regard to navigation questions before bonds may be issued. (Kelly-Florida)
W70-01601

SCHROEDER V ZIEGELMAN (RIGHT TO USE OF CANAL ON ANOTHER'S PROPERTY).
443 SW2d 16-19 (Ct App Mo 1969).

Descriptors: *Canal construction, *Excavation, *Missouri, *Relative rights, Canals, Conveyance structures, Judicial decisions, Water rights, Lakes, Lake shores, Inlets (Waterways), Land use, Land tenure, Usufructuary right, Legal aspects.

Plaintiff dug a canal extending inland from the water line of a lake across the property of a third party. Defendant, who had no interest in the canal property, filled in the excavation and stated that he would do so again if it were reopened. Plaintiff petitioned for an injunction prohibiting defendant from interfering with plaintiff's re-opening, maintaining, and using the canal. The trial court denied the injunction. On appeal, the court held that since plaintiff had dug the canal and had occupied and taken possession of the land, the injunction was proper. As against a mere tortfeasor, actual possession of land was alone sufficient to maintain an action in trespass, even though plaintiff was without title and had secured his possession originally without the consent of the title holder. That plaintiff may have violated rights of the title holder was immaterial as between the parties to the action. (Douberley-Florida)
W70-01606

THE NAVIGATION SERVITUDE,
John P. Turner.
Title News, Vol 48, No 1, p 42-49, Jan 1969. 8 p, 23 ref.

Descriptors: *Navigation, *Federal government, *Legislation, *Riparian rights, Navigable waters, United States, Legal aspects, Judicial decisions, Water law, Water policy, Condemnation, Riparian land, Structures, Landfills, Jurisdiction, Ownership of beds, Bays, Lakes, Rivers, High water mark, Streams, Low water mark, Dams, Mississippi River, Federal jurisdiction.
Identifiers: *Navigation servitude, Title insurance.

The problems encountered by title insurers in dealing with the navigation servitude are pointed out and the need for corrective legislation is examined. The term 'navigation servitude' is used to describe the fact that the federal government can take property lying within the boundaries of a navigable water body for purposes of navigation without compensating the property owner for the taking. While many aspects of the law concerning the navigation servitude are discussed, two are emphasized: (1) the navigation servitude extends to the ordinary high water mark of navigable streams and may be maintained at that level by artificial means; and (2) within that boundary line, title to all property is defeasible without compensation as against the exercise of the navigation power. The foregoing aspects of the law are examined as possible pitfalls for the insurer. The history of attempts to formulate legislation to meet insurer's problems in this area is discussed. Legislation being formulated by a subcommittee of the American Bar Association is examined from the insurers' viewpoint. The legislation would: (1) make government approval for fill areas act as an estoppel to the navigation servitude; and (2) make government permit issuance for structures act as an estoppel. (Keith-Florida)
W70-01612

LOCAL FLOOD PREVENTION AND WATER SUPPLY.

Va Code Ann secs 15.1-31, 15.1-37, 15.1-37.2 (1964), as amended, (Supp 1968).

Descriptors: *Virginia, *Dam construction, *Local governments, *Flood control, Construction, Dams, Levees, Sea walls, Riparian rights, Compensation, Governments, Public benefits, Legislation, Agriculture, Domestic water, Industrial water, Water sources, Water supply.

Any county, city, or town may construct a dam, levee, sea wall, or other structure, or perform dredging operations to prevent the flooding or inundation of such county, city, or town. No suit at law or equity shall be brought because of such construction or operations except when based on a written contract. This section does not authorize the taking of private property without just compensation. The governing body of every county and town is authorized to: make expenditures in order to acquire land, participate in the construction of dams, and perform all other acts necessary to provide public water for agricultural, residential,

overnmental, and industrial development of the ounty or town. (Smith-Florida)
/70-01621

AMAGES FROM MILLDAMS.
I Gen Laws Ann secs 46-18-1 thru 46-18-3, 46-8-10, 46-18-16 (1956).

escriptors: *Rhode Island, *Damages, *Milldams, Overflow, Legislation, Legal aspects, Flood amage, Ponds, Dams, Mills, Water supply, Rivers, treams, Natural streams, Relative rights, Obstruc-on to flow, Remedies, Usufructuary right, Water tilization.

/hen any person has set up any water mill or dam r the purpose of forming a pond to supply water any mill on the stream whereon the dam is cated, he may continue and improve the pond nd maintain the dam on his own land for his ad-ntage without molestations. Any person ag-rieved or injured by the maintenance of such a am may commence an action against the dam wner in the superior court of the county where the am is located. The mill and milldam complained , together with the land on which they are situ-ed, may be used to satisfy a judgment against the am owner. In such actions the amount of damages gainst the dam owner, if any, will be decided by e jury unless otherwise agreed by the parties. No erson owning a dam or any river or stream shall etain the natural stream thereof at any one time r more than twelve out of twenty-four hours hen he has been requested by a dam owner within ne mile below on the same stream to permit the atural stream to pass the lower dam. (Keith-lorida)
/70-01628

NSPECTION OF DAMS AND RESERVOIRS.
I Gen Laws Ann secs 46-19-1 thru 46-19-5 1956).

escriptors: *Rhode Island, *Dams, *Reservoirs, Supervisory control (Power), Safety, Legislation, egal aspects, Inspection, On-site investigations, urveys, Construction, Dam construction, Harbors, ivers, Bridges, Repairing, Flood protection, Ad-inistrative agencies, Regulation.
dentifiers: *Public safety, Injunctions (Mandato-y).

he Director of Public Works sees that a thorough spection of every dam and reservoir in the state is ade as often as is necessary to keep himself in-rmed of the condition thereof. Every person who wns or controls a dam or reservoir is to furnish the irector, on written request, as comprehensive a escription of such dam or reservoir as practicable, nd make all surveys, plans, and drawings thereof s may be required by the Director. No dam or eservoir is to be constructed or substantially al-ered until plans and specifications of the proposed ork have been filed with and approved by the irector. The Chief of the Division of Harbors and ivers, when application is made by specified arties, or when he has cause to apprehend that any am or reservoir is unsafe, sees that such dam or eservoir is viewed and thoroughly examined. If the hief considers the dam or reservoir unsafe, he ay order the owner thereof to lower the water evel and take such other remedial steps as are ecessary. If an owner fails to comply with such an rder, the attorney-general may seek injunctive re-ef as prescribed. (Keith-Florida)
/70-01629

IGHWAYS: DRAINAGE OF SURFACE ATER.

I Gen Laws Ann secs 24-8-32, 24-8-33 (1956).

escriptors: *Rhode Island, *Drainage systems, Highways, *Obstruction to flow, Barriers, Diver-ion, Alteration of flow, Drainage programs, rainage, Drainage water, Outlets, Sewers, Cul-verts, Administration, Administrative agencies, Legislation, State governments, Governments, Drainage systems, Surface water.

It is unlawful for any person to obstruct, block, or close any intake or outlet from any culvert, drain, or watercourse which has been placed and maintained under or within a state highway, without permission from the State Department of Public Works. It is also unlawful to make any connection into a state road drainage system or to drain or pump water onto a highway's travelled surface without permission. (Smith-Florida)
W70-01640

4B. Groundwater Management

COMBINED USE OF SURFACE AND GROUND WATER FOR THE WATER SUPPLY TO BARCELONA (SPAIN),
M. R. Llamas.
Bull Int Ass Sci Hydrol, Vol 14, No 3, p 119-136, Sept 1969. 18 p, 10 fig, 1 tab, 9 ref.

Descriptors: *Water supply, *Surface waters, *Groundwater, *Conjunctive use, Water quality, Aquifers, Water wells, Water pollution sources, Geology, Hydrogeology.
Identifiers: *Spain, *Barcelona.

The geological and hydrological characteristics of the groundwater reservoirs used for the Barcelona water supply are described. The connection between surface water and groundwater is emphasized. Groundwater meets about 50% of the current 360 mgd water demands for water supply to the Barcelona Metropolitan area. Present and future problems such as water pollution and water shortage, legal questions and education are discussed. The operational plan to solve or to avoid these problems is described. This plan includes combined use of surface and subsurface reservoirs for water conservation. (Knapp-USGS)
W70-01248

WATER-QUALITY IMPROVEMENT BY GROUND-WATER RECHARGE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 05D.
W70-01414

THE EFFECT OF SEEPAGE LOSSES ON STREAM REGIMEN,
Colorado State Univ., Fort Collins.
Donald D. DelManzo, Jr.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 30-34, 1969. 5 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Hydrologic budget, *Surface-groundwater relationships, *Return flow, *Mathematical models, Model studies, Streamflow, Infiltration, Groundwater movement, Irrigation water, Recharge, Alluvial channels, Alluvium, Consumptive use, Runoff, Water storage.
Identifiers: *South Platte River, Kersey (Colo), Julesburg (Colo).

Analysis techniques have been formulated for estimating underground water movement in the form of return flows resulting from irrigation. These techniques are applied to irrigation and precipitation water in a mathematical model of a large-scale 'river-aquifer system,' which describes a valley containing a perennial stream underlain by alluvial, water-conducting deposits such that essentially unobstructed flow can occur between stream and aquifer. To substantiate the validity of the groundwater analysis procedures, a model was developed to mathematically describe the interrelationships in the South Platte. The principle of the model was to use known input data, assumptions, idealizations, and analysis to calculate an estimated surface outflow at the downstream gage. If the calculated outflow significantly replicated the recorded outflow, then the theoretical procedures would be verified. The following budgetary equation was used: calculated flow at Julesburg= flow at Kersey+ reservoir return flow+ irrigation return flow+ base return flow - diversions to storage - diversions to irrigation - change in channel storage. (Knapp-USGS)
W70-01419

REVIEW OF METHODS FOR MEASURING AND PREDICTING SEEPAGE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W70-01420

FIELD EVALUATION OF SEEPAGE MEASUREMENT METHODS,
Idaho Univ., Moscow. Dept. of Civil Engineering; and Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
For primary bibliographic entry see Field 02G.
W70-01422

SALT BALANCE AND CRITICAL DEPTHS OF GROUND WATERS OF THE PART OF THE VAKH VALLEY UNDER IRRIGATION FOR MANY YEARS (RUSSIAN),
For primary bibliographic entry see Field 03F.
W70-01447

DETERMINING PERENNIAL RECHARGE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W70-01484

4C. Effects on Water of Man's Non-Water Activities

APPLICATION OF STANFORD WATERSHED MODEL CONCEPTS TO PREDICT FLOOD PEAKS FOR SMALL DRAINAGE AREAS; HPR-1 (3): KYHPR-64-23,
Lexington Dept. of Highways, Ky. Div. of Research.
K. D. Clarke.
Ky Dep Highways Res Rep, Jan 1968. 106 p, 36 fig, 16 tab, 23 ref. Available from Clearinghouse as PB 184 076, for $3 in paper copy, 65 cents in microfiche.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Flood forecasting, Rational formula, Routing, Mathematical models, Digital computers, Streamflow forecasting, Hydrographs, Hydrograph analysis, Simulation analysis, Water balance, Hydrologic budget.
Identifiers: *Stanford watershed model.

A study was made to achieve two principal objectives: (1) updating rainfall intensity-duration curves for the hydraulic design of culverts and (2) adaptation of the Stanford Watershed Model concept to small drainage basins in Kentucky. Total rainfall was equated to total runoff and losses throughout a span of years; the losses were then accounted for as evaporation, infiltration, and others. Ideally, all of the significant hydrological parameters may be deduced; then through direct measurements of some essential input descriptors and indirect estimates of others, the water-balance concept may be applied to other basins. (Knapp-USGS)
W70-01293

SEIFERT V SOUND BEACH PROPERTY OWNERS ASS'N (WATER DAMAGE FROM IMPROVEMENTS ON ADJACENT PROPERTY).

303 NYS2d 85-90 (Sup Ct 1969).

Descriptors: *New York, *Surface runoff, *Washouts, *Damages, Judicial decisions, Surface drainage, Channels, Land, Runoff, Cloudbursts, Drainage water, Overland flow, Rain water, Precipitation excess, Slopes, Soil erosion, Storm runoff, Floodwater, Floodways, Gullies, Erosion, Flood damage, Soil management.

Plaintiffs removed a large sand dune from the edge of their property but retained a low mound above an adjoining unimproved and sandy roadway. Defendant property owners association later removed several large sand dunes on property immediately adjacent to plaintiffs' property and opened up the roadway for vehicles. During a heavy rainstorm plaintiffs' land was damaged as heavy torrents of surface water rushed over the property from a channel created by removal of the dunes and the downhill grading of the improved roadway. Defendants were held liable for damages to the extent of restoring plaintiffs' eroded land and placing a protective barrier around the property. Removal of the sand dunes alone did not give rise to liability, but channeling the water onto plaintiffs' property by means of the newly improved roadway was held to be actionable. In opening the roadway, the defendant had an obligation to do so without creating a condition likely to cause damage to plaintiffs' property. That the surface waters would flow from the opened roadway onto plaintiffs' land should reasonably have been anticipated, and failure to take steps to prevent the damage constituted negligence. (Douberley-Florida)
W70-01607

MAINTENANCE OF TOWN HIGHWAYS.
R I Gen Laws Ann secs 24-5-16 thru 24-5-19, 24-5-23 (1956).

Descriptors: *Rhode Island, *Highways, *Artificial watercourses, *Bridges, Damages, Watercourses (Legal), Bodies of water, Surveys, Bridge construction, Ditches, Culverts, Local governments, Riparian rights, Legislation, Diversion.

No highway surveyor may cause any watercourse in any highway to be diverted so as to damage any person's land, house, store, shop, building, business, or occupation without the consent of the town council. Any person claiming such damage may complain to the town council. The council examines each claim and may direct the surveyor to alter said watercourse in such a manner as the council deems proper. Whenever any artificial watercourse is made under, through, or beside any previously existing highway, the proprietor of such watercourse must maintain all bridges and fences which are necessitated thereby. Whenever any highway is laid out over or beside any previously existing artificial watercourse, the town laying out such highway must maintain all necessary bridges and fences. Any owner of land adjoining any public highway may build bridges or culverts over ditches in such highway for the purpose of safe and convenient passage from his land to the highway. No such bridge or culvert may be disturbed except by order of the town council. (Smith-Florida)
W70-01639

4D. Watershed Protection

PERMISSION TO CAPTURE FLOODWATERS.
For primary bibliographic entry see Field 06E.
W70-01320

SOIL AND WATER CONSERVATION.
Miss Code Ann secs 4940, 4941, 4943, 4944, 4947, 4948 (Supp 1968).

Descriptors: *Mississippi, *Erosion control, *Soil management, *Administrative agencies, Legislation, Water conservation, Water policy, Water management (Applied), Water resources development, Conservation, Natural resources, Land management, Cost sharing, Erosion, Soil erosion, Contour farming, Demonstration farms, Land use, Soil conservation, Sediment control, Future planning (Projected), Projects, Project benefits, Project planning, Cost allocation, Cost-benefit ratio.

Provisions are made for the establishment of a state soil and water conservation committee, which is to aid commissioners of soil and water districts, to coordinate their activities, and to secure federal cooperation and assistance in soil and water conservation projects. Procedures for organizing a soil and water conservation district are set out, along with administrative powers and duties. Districts have the power: (1) to conduct soil and erosion research in cooperation with other federal and state agencies; (2) to conduct demonstration projects; (3) to carry out preventive and control measures, with the permission of landowners affected; (4) to give financial aid to individuals and to other agencies; (5) to make available material or equipment needed by landowners to aid in erosion control; (6) to construct or purchase necessary projects; (7) to develop a comprehensive erosion and resources plan; (8) to require cost-sharing by benefitted lands; and (9) to adopt water and land use regulations, subject to landowner approval by referendum. (Douberley-Florida)
W70-01602

DEVELOPMENT, CONSERVATION AND USE OF WATER RESOURCES.
For primary bibliographic entry see Field 06B.
W70-01619

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

BEHAVIOR OF SURFACTANTS AND OTHER DETERGENT COMPONENTS IN WATER AND SOIL-WATER ENVIRONMENTS,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 05B.
W70-01291

SAMPLING FOR WATER POLLUTION.
For primary bibliographic entry see Field 05G.
W70-01312

STUDIES ON THE LONGITUDINAL MIXING IN OPEN CHANNELS AND ITS EFFECT ON THE RATE OF THE B.O.D. REACTION IN AQUEOUS MEDIA (IN CZECH),
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W70-01381

NEUTRON INELASTIC SCATTERING STUDIES OF WATER AND IONIC SOLUTIONS,
Union Carbide Corp., Tuxedo, N.Y.
For primary bibliographic entry see Field 03A.
W70-01403

ATOMIC ABSORPTION AND FLAME EMISSION SPECTROSCOPY ABSTRACTS.
For primary bibliographic entry see Field 02K.
W70-01434

MICROELEMENTS IN THE WATER AND SUSPENDED SUBSTANCES OF RIVERS IN THE ASIATIC USSR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
G. S. Konovalov, A. A. Ivanova, and T. Kh. Kolesnikova.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 112-123, 1967. Soviet Hydrology: Selected Papers No 5, p 533-542, 1967. 5 fig, 1 tab, 10 ref.

Descriptors: *Trace elements, *Suspended load, *Rivers, Elements (Chemical), Manganese, Copper, Cobalt, Water quality, Water chemistry, Geomorphology, Climates, Temperature, Permafrost, Watersheds (Basins), Pacific Ocean.
Identifiers: *USSR, East Siberian Seas, Kara Sea, Laptev Sea, Zinc.

The concentration of V, Mn, Co, Ni, Cu, Zn, Mo, Ag, Sn, and Pb in water and suspended matter of the rivers of the Asiatic USSR is low. This is closely associated with the characteristic physiographic features of the river basins such as: (1) severe climate; (2) low temperatures over most of the year; (3) large volume of water in rivers; and (4) permafrost in the east. The role of the migration of elements in the dissolved form increases in the rivers of the Asiatic USSR. The importance of dissolved elements increases from west to east in the Kara Sea, the Laptev, and East Siberian Seas, and in the Pacific Ocean. The proposed sequence of elements in various basins is rather stable, except for Zn which migrates more with suspended substances in the rivers of the Laptev Sea basin. (Carsten-USGS)
W70-01449

CONTENT OF INDIVIDUAL GROUPS OF ORGANIC SUBSTANCES IN THE WATERS OF SOME SOVIET IVERS,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
A. D. Semenov, A. P. Pashanova, T. S. Kishkinova, and L. I. Nemtseva.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 171-177, 1967. Soviet Hydrology: Selected Papers No 5, p 549-554, 1967. 1 tab, 34 ref.

Descriptors: *Organic compounds, *Rivers, *Water quality, Organic matter, Amino acids, Proteins, Carbohydrates, Water properties, Humic acids.
Identifiers: *USSR, Nonvolatile organic substances, Organic carbon.

Data are presented on the composition of organic substances in several large rivers in the Soviet Union. The content of organic carbon in the river waters analyzed ranged from 1.9 to 14.9 mg/liter. The content of amino acids, proteins, and amines ranged from 0.04 to 0.025, 0.2 to 0.8, and 0.1 to 0.4 mg/liter, respectively. In terms of glucose carbon, free reducing sugars and complex carbohydrates amounted to 0.03-0.2 and 0.14-0.29 mg/liter. The humic acids varied broadly (5.5-450 mg C/liter). The total content of the mentioned groups amounted to 0.58-1.22 mg C/liter, that is 6-38% of the total content of nonvolatile organic substances determined from carbon. (Carstea-USGS)
W70-01450

BROMINE AND IODINE CONTENT IN THE WATER OF THE MAJOR RIVERS OF THE USSR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
T. Kh. Kolesnikova, and G. S. Konovalov.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 70-84, 1967. Soviet Hydrology: Selected Papers No 5, p 509-519, 1967. 1 tab, 29 ref.

Descriptors: *Rivers, *Water chemistry, *Iodine radioisotopes, Watersheds (Basins), Soils, Arid climates, Analytical techniques, Water quality, Ions.
Identifiers: *USSR, Bromine.

The bromine and iodine contents of water samples collected simultaneously in 30 of the largest rivers of the USSR are determined. Considerable differences in the physiographic conditions of the basins of large rivers determine the uneven dis-

tribution of bromine and iodine in the river waters of the Soviet Union. Low bromine and iodine concentrations are characteristic for rivers located in the wet zone and strongly leached soils. Conversely, in regions with a warm climate, the bromine and iodine concentrations are high. (Carstea-USGS)
W70-01451

VARIATION IN TIME OF THE ISOTOPIC COMPOSITION OF THE SULFUR OF SULFATE IONS IN THE WATERS OF THE DON AND VOLGA RIVERS,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
M. V. Veselovskiy, M. V. Bebeshko, S. A. Kozyrev, I. F. Polozhentsev, and V. S. Putentseva.
Translation from Gidrokhimicheskii Institut, Gidrokhimicheskiye Materialy, Vol 42, p 129-136, 1967. Soviet Hydrology Selected Papers No 5, p 543-549, 1967. 3 fig, 2 tab, 5 ref.

Descriptors: *Sulfates, *Rivers, *Radioisotopes, Ions, Analytical techniques, Water chemistry, Water quality, Gaging stations.
Identifiers: *USSR, Volga River, Don River, Sulfur isotopes.

The S-32/S-34 ratios in water of the Lower Don River (gaging station at Aksay City) ranged from 22.07 to 22.16 from October 1960 through June 1962. In the Volga River at Volgograd the ratio ranged from 22.04 to 22.11 from November, 1960 through December 1961. An inverse relationship was observed between the S-32/S-34 values and content of sulfate ions in water. (Carstea-USGS)
W70-01452

RARE AND DISPERSED ELEMENTS (MICROELEMENTS) IN THE WATER AND SUSPENDED SUBSTANCES OF RIVERS IN THE EUROPEAN USSR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-01453

COMPOSITION OF ORGANIC SUBSTANCES IN FLOOD WATERS FORMING IN SMALL CATCHMENTS OF THE ARID ZONE,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-01454

IMPROVEMENTS IN AUTOMATIC SAMPLING EQUIPMENT USED TO DETERMINE EXTENT OF POLLUTION IN RUNOFF FROM AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Washington, D.C.
W. M. Edwards, W. W. Bentz, and L. L. Harrold.
US Department of Agriculture, Agricultural Research Service ARS 41-151, ARS 41-151, p 1-16, May 1969. 16 p, 3 fig, 10 photo, 2 chart.

Descriptors: *Runoff, *Water pollution sources, Watersheds (Basins), Pollutant identification, Hydraulic equipment.
Identifiers: *Water pollution determination equipment.

Great care must be exercised in collecting, preparing, and storing runoff samples to be used in studying the loss of pesticides and other chemicals from agricultural lands. Several individual samples must be collected at variable predetermined time intervals throughout the runoff hydrograph of each storm. Each sample must be related to runoff rate at the time of sampling. A detailed description is presented of the construction and operation of automatic sampling equipment installed on experimental watersheds at Coshocton, Ohio. The equipment is designed to operate unattended. It remains on a standby basis and initiates a predetermined sampling sequence at the onset of runoff from the watershed. Samples are collected in 1-gallon glass jugs, which are stored in a refrigerator. The sampling mechanism turns itself off after the total number of samples is collected or if runoff stops before this. This composition of samples collected by the automatic equipment compares very favorable with that of samples collected by hand from below the flume. (National Agricultural Library)
W70-01478

RADIONUCLIDE DISTRIBUTION IN PACIFIC SALMON,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
W70-01577

5B. Sources of Pollution

THE USE OF TRACERS TO INVESTIGATE THE RELATIONSHIP BETWEEN MINING SUBSIDENCE AND GROUNDWATER OCCURRENCE AT ABERFAN, SOUTH WALES,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology; and National Coal Board, Ystrad Mynach (Wales).
For primary bibliographic entry see Field 02F.
W70-01268

BEHAVIOR OF SURFACTANTS AND OTHER DETERGENT COMPONENTS IN WATER AND SOIL-WATER ENVIRONMENTS,
Geological Survey, Washington, D.C. Water Resources Div.
Cooper Wayman, H. L. Page, and J. B. Robertson.
Fed Housing Admin Tech Studies Publication No FHA 532, Feb 1965. 136 p, 104 fig, 22 tab, 283 ref.

Descriptors: *Surfactants, *Alkybenzene sulfonates, *Detergents, *Groundwater movement, *Water pollution, Infiltration, Analytical techniques, Soil contamination effects, Organic compounds, Dispersion, Sewage effluents, Biodegradation, Methodology.
Identifiers: *Detergent behavior (Water), *Soil-water environment, Anionic surfactants, Synthetic detergents.

This report is primarily concerned with alkylbenzene sulfonate (ABS), the anionic surface-active agent most frequently found in water supplies. The mechanisms and physical principles of detergent movement underground are discussed in a manner to provide background for engineering analysis of pollution problems. Unlike other organic wastes, ABS is not easily broken down by microorganisms, and it moves with sewage effluent, often into groundwater. ABS can be detected in low concentrations and thus used to trace the pollution. The report provides a good technical basis for understanding detergent movement underground; it does not constitute an FHA standard. (Lang-USGS)
W70-01291

IMPOUNDING RESERVOIRS ON RIVERS, THEIR SIGNIFICANCE FOR THE DISPOSAL OF SEWAGE AND THEIR RELATION TO SECONDARY CONTAMINATION (IN CZECH),
Institute of Hygiene, Prague (Czechoslovakia).
For primary bibliographic entry see Field 05C.
W70-01382

TURBULENT BUOYANT CONVECTION FROM A SOURCE IN A CONFINED REGION,
Cambridge Univ. (England). Dept. of Applied Mathematics.
For primary bibliographic entry see Field 08B.
W70-01390

TIME-OF-TRAVEL STUDY - MOHAWK RIVER, ROME, NEW YORK TO COHOES, NEW YORK,
Geological Survey, Albany, N.Y.
Harold L. Shindel.
NY State Water Resources Comm Rep of Invest RI-6, 1969. 48 p, 14 fig, 6 tab, 11 ref, 2 append.

Descriptors: *Fluorescence, *Dye releases, *Pollutants, *Velocity, *New York, Channel flow, Hydroelectric plants, Duration curves, Dams, Canals.
Identifiers: *Dye tracing, *Time of travel, Natural purification, Sanitation, Mohawk River, Erie (Barge) Canal.

Flow rate was determined for the 119-mile reach of Mohawk River from Gate 6, Rome, N.Y. to Crescent Dam, Cohoes, N.Y. Large quantities of municipal and industrial effluents are discharged into this reach. A 40% Rhodamine B dye solution was used for traveltime studies during periods of low flow (summer 1966) and high flow (spring 1967). The cumulative time-of-travel for all subreaches was 840 hours for low flows and 210 hours for high flows. Graphs are presented showing magnitude and frequency of discharge and the relationship between traveltime and discharge by subreaches. Based on shape and use, each subreach was classified into one of three types of channel sections: (1) natural river, (2) river-canal, or (3) the power-pool section. The natural river sections include 39.1 mi of the study reach, characterized by shallow cross sections and widening channels, where the traveltime is least. In the 58.9 mi of river-canal, the channel is straightened, dredged, and dammed for canal traffic. Traveltime through the power pools is controlled by the two distinct periods of high and low flow during the canal operation season. (Lang-USGS)
W70-01404

MINAMATA DISEASE AND WATER POLLUTION BY INDUSTRIAL WASTE,
Tokyo Univ. (Japan).
Jun Ui.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 37-44, 1969. 1 fig, 5 ref.

Descriptors: *Industrial waste, *Public health, *Water pollution, Industrial plants, Waste water disposal.
Identifiers: *Acetaldehyde synthesis, *Minamata disease, *Organomercuric compound, Chemical industry, Japan.

The author demonstrates the presence of an organomercuric compound in the waste water from the Minamata Factory. The organomercuric compound is a degradation product of a catalyst used in the manufacture of acetaldehyde. The waste water containing the organomercuric compound is discharged to the sea. The author claims that this discharge causes Minamata disease; the factory denies this. (Tyner-Washington)
W70-01465

FORMALIZED THEORY OF THE DIFFUSION OF CHEMICAL PRODUCTS IN THE SEA (FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, and N. Desirotte.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 125-156, 1969. 13 fig, 2 tab, 8 ref.

Descriptors: *Diffusion, *Mathematical models, *Path of pollutants, *Water pollution, Biodegradation, Dispersion.
Identifiers: *Zones of pollution, Long-term effects, Short-term effects.

The authors establish mathematical models for calculating approximate zones of pollution resulting from transitory and continuous emissions of waste water containing toxic chemicals. They then give an example of the application of their method. (Tyner-Washington)
W70-01469

EFFECTS OF 'TORREY CANYON' TYPE POLLUTION ON THE UNICELLULAR MARINE

ALGA PHAEODACTYLUM TRICORNUTUM (FRENCH),
Laboratoire de Physiologie Generale et Comparee du Museum, Paris (France); and Laboratoire de Physiologie des Etres Marins de l'Institut Oceanographique, Paris (France).
For primary bibliographic entry see Field 05C.
W70-01470

APPEARANCE OF RED WATER CAUSED BY COCHLODINIUM SP. IN THE BAY OF JUAN-LES-PINS (FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
For primary bibliographic entry see Field 05C.
W70-01472

IMPROVEMENTS IN AUTOMATIC SAMPLING EQUIPMENT USED TO DETERMINE EXTENT OF POLLUTION IN RUNOFF FROM AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Washington, D.C.
For primary bibliographic entry see Field 05A.
W70-01478

NATURAL CONTAMINATION HAZARDS IN ARID BASINS,
Geological Survey, Washington, D.C.
J. H. Feth.
In: Groundwater Development in Arid Basins - Symposium, Utah State University, 1967, Proceedings. Utah State University, Logan, p 21-35, 1967. 15 p, 4 fig, 1 tab, 27 ref.

Descriptors: *Arid lands, *Great Basin, *Water quality, *Salinity, *Water pollution, Groundwater, Atmosphere, Brines, Phreatophytes, Dissolved solids, Aquifers.
Identifiers: *Natural contamination sources, Lithosphere.

Examples of contamination by naturally occuring chemical substances in the Great Basin area are discussed. The patterns appear to be similar to those in Arizona, New Mexico and Texas. They were comparable to conditions known in Australia, the Sahara, the Middle East and other arid or semiarid regions. Sources of contamination in the atmosphere, lithosphere, hydrosphere and biosphere as well as chemical characteristics of various contaminated waters were also discussed. Since the Great Basin has been without exterior drainage as far back as the Pleistocene, the amount of potable water of good quality that does occur raises questions which are largely unanswered. (Crouse-Arizona)
W70-01485

RELEASE OF DISSOLVED ORGANIC MATTER BY MARINE SEAWEEDS AND DISTRIBUTION OF THEIR TOTAL ORGANIC PRODUCTION TO INSHORE COMMUNITIES,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
K. M. Khailov, and Z. P. Burlakova.
Limnology and Oceanography, Vol 14, No 2, p 521-527, 1969. 2 fig, 5 tab, 15 ref.

Descriptors: *Organic matter, *Marine plants, *Distribution, *Productivity, Phaeophyta, Rhodophyta, Chlorophyta, Decomposing organic matter, Herbivores, Ecology, Biomass, Ultraviolet radiation, Spectrophotometry, Solar radiation, Temperature, Kinetics, Photosynthesis, Littoral, Synthesis, Seasonal, Respiration, Detritus, Eutrophication, Water pollution sources.
Identifiers: *Release rates, *Inshore communities, Barents Sea, Black Sea, Dasya, Macrophytes, Fucus, Ascophillum, Laminaria, Rhodimenia, Cystoseira, Enteromorpha, Polysiphonia, Cladophora, Callithamnion, Dilophus, Ceramium, Laurencia, Cladostephus, Trophodynamics, Metabolites.

Release rates are estimated of organic matter for macrophytes, five species from Barents Sea and thirteen from Black Sea, under controlled experimental conditions. Rates (in milligrams organic matter/gram (dry weight) of plant per hour) for Barents Sea species varied between 0.9 and 2.9 weight of plants/hour in March; between 1.7 and 9.8 in June. For species from the Black Sea, rates were in range of 1.25 to 6.1 in fast growing plants and 0.5 to 1.6 in slowly growing plants. Total dissolved organic matter released per year have been calculated to be about 39% of gross production in brown algae; about 38% in red algae; and about 23% in green algae. Remainder or organic matter, approximately 30%, was released during decomposition of that part of standing stock not consumed by herbivorous animals. Thus, the total flow of dissolved organic matter from seaweeds during growth and after death may be as much as 70% of their gross production. Ecological significance is discussed of external organic metabolites released to the hydrosphere. (Jones-Wisconsin)
W70-01576

RADIONUCLIDE DISTRIBUTION IN PACIFIC SALMON,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
C. E. Jenkins.
Health Physics, Vol 17, p 507-512, 1969. 2 tab, 23 ref.

Descriptors: *Radioecology, *Salmon, *Pacific Ocean, *Radioisotopes, Gamma rays, Manganese, Cobalt radioisotopes, Alaska, Oregon, Washington, Cesium, Columbia River, Nuclear explosions, Radium radioisotopes, Sodium, Potassium radioisotopes, Iron, Zinc radioisotopes, Sea water, Tracers, Phytoplankton, Food chains, X-rays, Spectrometry, Lead radioisotopes, Analytical techniques, Neutron activation analysis, Effluents, Migration patterns, Fresh water, Fallout, Water pollution sources.
Identifiers: Muscle, Nuclear tests, Scandium radioisotopes, Chromium radioisotopes, Yttrium radioisotopes, Silver radioisotopes, Barium radioisotopes, Europium radioisotopes, Mercury radioisotopes, Tellurium radioisotopes, Concentration factors, Eskimos, Liver, Bone, Seward (Alas), Kenai (Alas), Alakanuk (Alas), Half-life, Thorium radioisotopes, Feeding pattern, Cosmic rays, Bering Sea, Latitudinal distribution, Health physics, Indians.

Because salmon comprises a major portion of diet of Eskimos and Indians living on the west coast of Alaska, author measured 17 gamma-emitting radionuclides in four species of Pacific salmon. Along a gradient from northwestern Alaska through southern Alaska, to the Oregon-Washington Coast, concentrations in salmon muscle tissue decreased by factors from 1.5 to 3 for manganese-54, and 4.5 to 12 for cobalt-60, while concentrations of cesium-137 decreased less pronouncedly (approximately 25%). The Columbia River, Chinese nuclear testing, and other parameters influenced distribution patters of other radionuclides. For manganese-54, cobalt-60, zinc-65, and silver-110m, concentrations were 10- to 100-fold higher in liver as compared with muscle tissue, indicating that the former might serve as a sensitive monitor for presence and approximate concentrations of radionuclides in muscle. Relatively high concentrations of naturally occurring radium-226 in Alaskan salmon, in association with higher levels of artificial radionuclides, are sufficient to cause native fish-eating populations to exceed their maximum permissible concentrations (MPC), where percentage MPC is based upon intakes of 600 grams salmon/day (using MPC/30 as recommended by the International Committee for Radiological Protection for non-occupationally exposed individuals). Author also measured sodium-22, potassium-40, scandium-46, chromium-51, cobalt-57, iron-57, iron-59, barium-140, europium-152, mercury-203, and tellurium-208. (Jones-Wisconsin)
W70-01577

5C. Effects of Pollution

HYDROGRAPHY OF THE BALTIC DEEP BASINS III,
Fishery Board of Sweden.
For primary bibliographic entry see Field 02L.
W70-01245

IMPOUNDING RESERVOIRS ON RIVERS, THEIR SIGNIFICANCE FOR THE DISPOSAL OF SEWAGE AND THEIR RELATION TO SECONDARY CONTAMINATION (IN CZECH),
Institute of Hygiene, Prague (Czechoslovakia).
J. Gabriel.
Summaries in English and Russian. Ceskoslovenska Hygiena, V 2-3, (1969) p 166-171.

Descriptors: *Reservoirs, *Water pollution effects, Erosion, *Thermal stratification, *Waste disposal, Water supply, Water quality, Environmental effects, Biochemical oxygen demand, Dissolved oxygen, Organic compounds, Bacteria, Phytoplankton, Surface waters.

The results of comprehensive research on the reservoir Sedlice is presented. This research is focused on the problem of changes in the quality of running water after its impoundment. These changes in the quality of the water were substantially influenced by the 'accumulation factor.' The occurrence of thermal stratification is discussed. Utilizing five indicators (oxygen, organic substances, BOD-5, bacteriomass, phytobiomass) the author demonstrates the favourable effect of this accumulation factor on the quality of water in the reservoir which is connected with the river. By comparison of balance calculations of the accumulation of inflowing water contaminated with waste waters and accumulation without contamination, it was shown that according to some indicators (BOD-5, organic substances) the waste waters account only for 30 percent of the contamination, while surface run off accounts for 70 per cent. From the sanitary point of view, waste waters are not comparable with erosion materials from cultivated soil. Despite this fact it is necessary, with regard to raising the quality of the water in valley reservoirs, to seek effective means of eliminating this surface run off (danger of secondary 'self-contamination'). (novotny-Vanderbilt)
W70-01382

RECHARGING CONSERVES NUCLEAR REACTOR COOLING WATER,
Brookhaven National Lab., Upton, N.Y.
S. H. Wichman, and G. K. Ahlers.
Water and Wastes Engineering, p 79-81, Mar 1967. 4 fig.

Descriptors: *Cooling water, *Recharge, Lagoons, Radioactivity, Ground water.
Identifiers: Reactor-cooling.

A simple well water recycling system has cooled the medical research reactor at the Brookhaven laboratory for five years, without disturbing the natural ground water balance. The reactor is cooled, shielded and moderated by forced circulation of highly purified well water in a closed primary loop, which in turn is cooled by untreated well water. The two systems are never in contact. Additional heat from the dry graphite reflector is removed by forced draft filtered air. The used warm water is piped into one of the two recharge basins, consisting of ordinary precast drainage domes placed over perforated concrete slabs. Effective recharge area is about 1/4 acre. At maximum flow of 2600 gpm, the disposal rate is 0.25 gpm/ft sq, or percolation velocity of 0.4 in. per min. With the continuous disposal of the warm water, no measurable increase of the ground water temperature in the two wells at a distance of 1300 and 2100 feet from the basins has been found. A number of elaborate safeguards against leakage in the heat exchanger have been taken. With daily changeover of the basins, little maintenance is necessary. (Rietveld-Vanderbilt)
W70-01385

THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS. 1. A GENERAL METHOD OF CALCULATION,
Army Terrestrial Sciences Center, Hanover, N.H.
S. L. Dingman, W. F. Weeks, and Y. C. Yen.
CRREL, Research Report 206, Dec 1967. 35 p, 7 fig, 21 ref.

Descriptors: *Thermal pollution, *Ice, *Rivers, Navigation.

An attempt is made to calculate the length of the ice-free reach which develops during the winter below a thermal pollution site on a river. A differential equation for the steady state heat balance of a volume element of a river is developed, which leads to the expression: x= (C sub x) the integral from (T sub wo) to (T sub wx) of (d (T SUB W)/Q (*)) where x is distance downstream from the pollution site to the cross section where the water temperature equals (T sub wx), (T sub wo) is water temperature at x equals zero, Q (*) is rate of heat loss from the water surface, and C sub x is a constant which includes flow velocity and depth. The value of x at T sub wx equals 0 deg C is taken as the length of the ice-free reach. Q (*) is the sum of the heat losses due to evaporation, convection, long and short wave radiation, and other processes, each of which is evaluated by an empirical or theoretical expression. The two principal limitations in accurately calculating downstream temperature changes are related to difficulties in evaluating the degree of lateral mixing in natural rivers and the convective and evaporative heat losses under unstable atmospheric conditions. Observations of lengths of ice-free reaches on the Mississippi River are in good agreement with the calculated values. Significant portions of the St. Lawrence Seaway can be kept ice-free by the installation of nuclear reactors at appropriate locations. (Upadhyaya-Vanderbilt)
W70-01392

THE ZONE OF POLLUTIONAL EFFECTS (IN FRENCH),
Belgrade Univ. (Yugoslavia).
S. Jankovic, and F. Edeline.
Tribune Du Cebedeau, 21 (1968), No 297-298, p 373-377.

Descriptors: *Water pollution effects, *Water pollution sources, *Pollutant identification, *Thermal pollution, Mixing, Water quality, Standards, Waste dilution, Waste disposal, Self-purification, Biochemical oxygen demand, Stratified flow, Dissolved oxygen, Stratification.

The definition of the size of the zone of pollution influence is stated according to the literature survey presented in the paper. The pollution and its influence is distinguished into 6 groups; (1) thermal pollution (calories), (2) dissolved solids, (3) colloids, (4) suspended solids, (5) sediments, and (6) solids reacting chemically with the aqueous environment. To determine the zone of influence, knowledge of hydraulic parameters is of importance. Two different approaches are mentioned; (1) Czechoslovakian definition--the zone of influence could be looked upon as the zone where exceeding a limit is tolerable, the dilution of pollutants is calculated as the dilution by the entire discharge, (2) Romanian definition--the zone of influence represents a factor of safety, the comparison of diluted pollutants to limits is carried out in a part of the stream, not in the entire cross section. The results of several studies found in the literature are presented and discussed. (Novotny-Vanderbilt)
W70-01395

RECORD LOW DISSOLVED OXYGEN IN THE ISLAND AREA OF LAKE ERIE,
Ohio State Univ., Columbus. Coll. of Biological Sciences; and Ohio State Univ., Dept. of Zoology and Entomology.
N. Wilson Britt, Edwin J. Skoch, and Kenneth R. Smith.
The Ohio J Sci, Vol 68, No 3, p 175-179, May 1968. 5 p, 1 fig, 12 ref.

Descriptors: *Lake Erie, *Lakes, *Dissolved oxygen, Sampling, Seasonal, Winter, Summer, Air temperature, Statistical methods, Wind velocity, Dissolved solids, Plant growth, Nutrients, Nitrogen, Phosphorus, Physicochemical properties, Weather patterns, Climates.
Identifiers: *Oxygen depletion (Lake Erie), Lakewater dissolved oxygen.

The dissolved oxygen content of Lake Erie was investigated by collecting daily samples from June 22 to August 31, 1966 at a single station south of Rattlesnake Island. Dissolved oxygen near the bottom fluctuates considerably from 0.1 ppm recorded on July 1 to 9.2 ppm on July 19. Two more low periods were recorded on August 7 (3.7 ppm) and August 30 (3.0 ppm). In each of these 2 cases, the low-oxygen condition was associated with an average wind speed of about 6 knots and air temperature of about 26 deg C. Statistical analysis indicates a significant relationship between wind speed and dissolved oxygen. (Gabriel-USGS)
W70-01425

PRIMARY PRODUCTIVITY - PHYTOPLANKTON RELATIONSHIPS, HODGSON LAKE, PORTAGE COUNTY, OHIO,
Kent State Univ., Ohio. Dept. of Biological Sciences.
John H. Olive, John H. Morrison, and Charles V. Riley.
The Ohio J Sci, Vol 68, No 3, p 152-160, May 1968. 9 p, 4 fig, 3 tab, 30 ref.

Descriptors: *Lakes, *Productivity, *Phytoplankton, *Ohio, Diatoms, Seasonal, Winter, Photosynthesis, Carbon, Organic matter, Biomass, Chlorophyll, Temperature, Ice, Chlorides, Oxygen, Silica, Phosphates, Iron, Light penetration.
Identifiers: Hodgson Lake (Ohio), Lake productivity.

Primary productivity-phytoplankton relationships were studied in 1963-1964 in Hodgson Lake, Ohio. The lake was found to be a 'blue-green-diatom' reservoir of moderate productivity, but containing a large phytoplankton standing crop. Average cell volumes varied from 1.4 cu mm per liter in September to about 88.6 cu mm per liter in June. Photosynthesis ranged from 4-5 mgC per sq m per day during the winter and about 2600-2700 mgC per sq m per day in June and October. (Gabriel-USGS)
W70-01426

CHRONIC TOXICITY OF COPPER TO THE FATHEAD MINNOW (PIMEPHALES PROMELAS) IN SOFT WATER,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Newtown Fish Toxicology Lab.
Donald I. Mount, and Charles E. Stephan.
J Fish Res Bd Canada, Vol 26, No 9, p 2449-2457, 1969. 6 tab, 8 ref.

Descriptors: *Copper, *Hardness (Water), *Minnows, *Toxicity, Fish.
Identifiers: *Application factor, *Pimephales promelas, Toxicity bioassay, Chronic toxicity, 96-hr TLm.

The application factor is defined by the authors as the 'maximum acceptable toxicant concentration (MATC)' divided by the 96-hr TLm. They suggest the application factor as a means of determinimg safe concentrations of toxic pollutants. In this paper they determine that the MATC of copper for the fathead minnow (Pimephales promelas) in water having an EDTA hardness of 30 mg/liter (as CaCO3) is between 0.13 and 0.22 of the 96-hr TLm value. In an earlier study the application factor for copper in water with an EDTA hardness of 200 mg/liter (as CaCO3) was found to be between 0.03 and 0.08 for the same species. Various factors lead the authors to conclude that the experiments reported are not conclusive evidence that hardness does or does not affect the application factor for copper and fathead minnows. They suggest refinements which should increase the accuracy and precision of future determinations of application factors. (Tyner-Washington)
W70-01458

EFFECTS OF THE TREATMENT OF AN OYSTER BED WITH POLYSTREAM AND SEVIN,
Virginia Inst. of Marine Science, Gloucester Point.
Dexter Haven, Michael Castagna, Paul Chanley, Marvin Wass, and James Whitcomb.
Chesapeak Sci Vol 7, No 4, p 179-188, Dec 1966. 9 tab, 12 ref.

Descriptors: *Molluscasides, *Oysters, *Pest control, *Pesticides, *Snails, Mollusks, Benthic fauna.
Identifiers: *Crassostrea virginica, *Drills, *Polystream, *Sevin, *Urosalpinx cinerea, Hog Island Bay (Va).

A series of field tests near Wachapreague, Virginia, in 1963 evaluated Polystream and Sevin mixed with sand as a means of controlling populations of oyster drills, Urosalpinx cinerea. Tests were designed to evaluate effects on planted oysters, drills, drill egg case deposition, crabs, and benthic invertebrates. Application of the chemicals to planted oyster beds did not reduce drill populations or numbers of drill egg cases deposited. Oyster production was not increased and treatment had an adverse effect on most species of benthic macroinvertebrates. Absence of drill control could have been associated with mixing of treated sand into subsurface deposits but other factors may have been involved. (Tyner-Washington)
W70-01459

SHORT-TERM EFFECTS OF 2,4-D ON AQUATIC ORGANISMS IN THE NAKWASINA RIVER WATERSHED SOUTHEASTERN ALASKA,
Bureau of Commercial Fisheries, Auke Bay, Alaska.
Howard S. Sears, and William R. Meehan.
US Dept of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, Biological Laboratory, Auke Bay, Alaska, Sept 1969. 24 p, 2 tab, 11 appended tables.

Descriptors: *Herbicides, *Trout, *Diptera, Aquatic animals, Aquatic insects.
Identifiers: *2-4-D, *Nakwasina River, *Vegetation control, Aerial spraying, Coho salmon fry, Plecoptera, Ephemeroptera, Dolly Varden trout.

The Forest Service sprayed 2,4-D on logged off land on Baranof Island to control Red alder at a rate of 2 lbs/acre. There was no significant immediate mortality to fish (Coho salmon and Dolly Varden) and aquatic insects even in streams that were sprayed directly. Water samples and fish tissue samples analyzed for 2,4-D content showed concentration levels below those considered lethal. (Katz-Washington)
W70-01460

ECOLOGICAL MANAGEMENT PROBLEMS CAUSED BY HEATED WASTE WATER DISCHARGE INTO THE AQUATIC ENVIRONMENT,
Virginia Polytechnic Inst., Blacksburg.
John Cairns, Jr.
The Governor's Conference on Thermal Pollution, July 18, 1969, Traverse City, Michigan. Published Aug 1969 Michigan Water Resources Commission, p 21-30, Aug 69. 21 ref.

Descriptors: *Water temperature, *Thermal pollution, Ecosystems, Fish physiology, Mortality, Thermal stress.
Identifiers: *Heated waste waters, *Physiological stress, *Heat death, Physiological aberrations.

A brief, general discussion of the effects of heated discharges upon the ecosystem and the presentation of four alternatives that would allow heated discharges without serious degradation of the ecosystem. (Katz-Washington)

W70-01461

ORGANOCHLORINE PESTICIDES IN THE ENVIRONMENT,
Bureau of Sport Fisheries and Wildlife, Laurel, Md. Patuxent Wildlife Research Center.
Lucille F. Stickel.
Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Special Scientific Report - Wildlife No 119, Oct 1969. 32 p, 3 tab, 210 ref.

Descriptors: *Pesticides, *Pesticide kinetics, *Pesticide toxicity, *Chlorinated hydrocarbon pesticides, Pesticide residues, Aquatic life.
Identifiers: *Residues-birds, *Field mortalities, *Population changes, *Physiology, *Reproductive changes, Residues - fish and shellfish.

A thoroughly and extensively documented review of the biological changes caused by chlorinated hydrocarbon pesticides. Author documents the residues found in wild animals, fish, shellfish, birds, including water birds. The kinetics of chlorinated hydrocarbon pesticides in the aquatic and terrestrial environment is described. Experimental studies of pesticide kinetics in the individual organisms including fish and shell fish are described and the results are presented. A list of some pesticide mortalities of fish and fish-eating birds is given. The changes in populations of fish, aquatic insects, and birds are described. The changes in the reproductive patterns of mammals, birds, and fish subjected to chlorinated hydrocarbons are described. The data on the changes in reproduction, especially that of fish-eating birds in relation to residues in eggs and adults, is presented. Research needs are also discussed. (Katz-Washington)
W70-01462

THE BIOLOGICAL AND ECOLOGICAL EFFECTS OF ACID MINE DRAINAGE WITH PARTICULAR EMPHASIS TO THE WATERS OF THE APPALACHIAN REGION,
Washington Univ., Seattle. Coll. of Fisheries.
Max Katz.
'Impact of Mine Drainage on Recreation and Stream Ecology', Appendix F, Ecology in Acid Mine Drainage in Appalachia, Appalachian Regional Commission, Washington, DC, June 1969. 65 p, 5 tab, 200 ref.

Descriptors: *Acid mine water, *Brook trout, *Appalachian Mountain Region, *Water pollution, *Toxicity, Eco system, Fish stocking effects, Water resources, *Acid streams, Birds, Mammals, Reptiles, Aquatic plants, Bioassays, Domestic wastes, Self purification, Fish reproduction.
Identifiers: *Fathead minnow, *pH, Dissolved iron, Fish growth, Benthos, Fishery management procedures.

An extensive review of the published world literature on the effects of acidic waters and acid mine drainage water on the receiving streams. Spawning of fish is inhibited below pH 7.0. Brook trout are more tolerant to low pH than rainbow trout and can tolerate pH below 5.0 and 6.0. The cause of death of fish held at low pH is due to acidemia. If food is sufficient, fish can grow well in water below pH 7.0. Acid waters can be reclaimed by adding lime. In acid lakes as the pH increases toward neutrality, the number of aquatic plants increases. Aquatic insects are limited by pH levels below 4.0. Purification of domestic wastes is inhibited in acid mine waters. A stocking program of trout will provide recreational fishing if the pH is maintained above 6.0. For non-trout species, the pH should be maintained at pH 6.5 or above, but stocking is not required. (Katz-Washington)
W70-01463

MEDICAL ASPECTS OF MINAMATA DISEASE,
Kumamoto Univ. (Japan).
Haruhiko Tokuomi.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 5-35, 1969. 13 fig, 6 tab, 11 ref.

Descriptors: *Epidemiology, *Industrial wastes, *Public health, *Water pollution, Heavy metals.
Identifiers: *Minamata disease, *Organic mercury poisoning, Japan.

The epidemiological, clinical and pathological features of the outbreak of Minamata disease in Minamata City in Kumamoto Prefecture, Kyushu, Japan, are reported. There is in the city a factory whose wastes discharged into the nearby waters contain mercury. The fish and shellfish taken in these waters contain high levels of mercury. (Tyner-Washington)
W70-01464

STUDY OF THE TOXICITY OF CHEMICAL PRODUCTS WITH RESPECT TO THE MARINE FOOD CHAIN (FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, R. Charra, and G. Malara.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 45-72, 1969. 14 fig, 7 tab, 7 ref.

Descriptors: *Detergents, *Insecticides, *Toxicity, *Water pollution, Food chains, Aquatic algae, Brine shrimp, Fish, Mussels.
Identifiers: *Hydrocarbon, *Toxicity threshold.

The threshold toxicities of 5 chemical pollutants (3 detergents, 1 insecticide, 1 hydrocarbon) were determined for organisms from 3 levels of the food chain (phytoplankton, zooplankton, fish). The results show that the toxicity of the chemicals varies from one organism to another and from one life stage to another in the same organism. (Tyner-Washington)
W70-01466

STUDY OF THE BIODEGRADABILITY OF TOXIC CHEMICAL PRODUCTS WITH RESPECT TO THE MARINE FOOD CHAIN (FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, and J. P. Gambarotta.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 73-105, 1969. 19 fig, 3 tab, 8 ref.

Descriptors: *Biodegradation, *Detergents, *Insecticides, *Marine bacteria, *Toxicity, *Water pollution, Aquatic algae, Brine shrimp, Fish, Food chains, Mussels.
Identifiers: *Hydrocarbon.

Test solutions of 5 chemical pollutants (3 detergents, 1 insecticide, 1 hydrocarbon) at concentrations twice the previously determined threshold doses for the organisms in question were subjected to degradation by marine microorganisms for 3, 6, or 9 days prior to the introduction of the test organisms. These organisms were drawn from different levels of the food chain; primary producers, 2 species of phytoplankton· herbivores, zooplankton and mussels; carnivores, fish. In some cases biological degradation of the chemical pollutant caused a reduction in toxicity. (Tyner-Washington)
W70-01467

STUDY OF THE EFFECTS OF CHEMICAL POLLUTANTS ON PLANKTON: DEGRADABILITY OF FUEL BY SOIL AND MARINE MICROORGANISMS (FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
M. Aubert, J. Aubert, S. Daniel, and J. P. Gambarotta.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 107-123, 1969. 9 fig, 10 ref.

Descriptors: *Biodegradation, *Fuel, *Marine microorganisms, *Water pollution, Diatoms.
Identifiers: *Hydrocarbon, *Terrestrial microorganisms, Asterionella japonica.

The authors determined the threshold toxicity of fuel oil on the marine diatom Asterionella japonica. They allowed marine microorganisms and terrestrial microorganisms from sewage to biodegrade the fuel oil and then they introduced cultures of the diatoms. The resulting growth curves showed the extent to which the microorganisms had detoxified the fuel oil. The authors estimate that the microorganisms in the marine environment can degrade approximately 200 grams of fuel oil per cubic meter per year. (Tyner-Washington)
W70-01468

EFFECTS OF 'TORREY CANYON' TYPE POLLUTION ON THE UNICELLULAR MARINE ALGA PHAEODACTYLUM TRICORNUTUM (FRENCH),
Laboratoire de Physiologie Generale et Compare du Museum, Paris (France); and Laboratoire de Physiologie des Etres Marins de l'Institut Oceanographique, Paris (France).
J. C. Lacaze.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 157-179, 1969. 3 fig, 2 tab, 36 ref.

Descriptors: *Detergents, *Diatoms, *Oil, *Oil wastes, *Surfactants, *Water pollution, Cleaning, Disasters, Oily water, Marine algae, Ships.
Identifiers: *Crude oil, *Gamosol, *Oil spills, *Torrey Canyon, Aromatic solvents, Phaeodactylum tricornutum.

The author studied the effects of both crude oil (of the sort carried by the 'Torrey Canyon') and Gamosol (a detergent used to disperse oil) on Phaeodactylum tricornutum, a marine diatom. A 10% reduction in growth was observed in cultures prepared with 1% petroleum extracts. After aeration the reduction in growth was 5%, some toxic volatile compounds having been eliminated and the oxygen concentration increased. Petroleum extracts which had been previously raised to a temperature above 100 deg C exhibited an increased toxicity (35% reduction in growth). Gamosol (14% nonionic surfactants and 86% aromatic solvents) is more toxic (50% reduction in growth after exposure to 5.6 ppm) than the surface active fraction (50% reduction in growth after exposure to 8 ppm). However, this toxicity varies because of the high volatility of the solvent in dilute solution. A 30 minute exposure to 40 ppm Gamosol killed the cells. (Tyner-Washington)
W70-01470

THE PROBLEM OF RED WATER (FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
J. M. Pincemin.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 181-203, 1969. 3 fig, 61 ref.

Descriptors: *Dinoflagellates, *Red tide, Fishkill, Public health, Nutrients, Salinity, Water temperature.
Identifiers: *Causes of red water, *Red water.

The author through personal research and bibliographic study surveys the problem of red water. He begins by enumerating its characteristics: color, categories and numbers of individuals, localization, duration and toxicity. He then looks at the evolution of the process. The seawater is calm and has a temperature higher than the preceding days. The salinity is generally lower. The quantity of nutrients, though larger than usual, is not sufficient to explain the high rate of multiplication. The accumulation of organisms is therefore explained by accelerated multiplication in a thick layer of seawater followed by vertical concentration (positive phototaxis and reduced density of the organisms) and horizontal concentration by winds. The usual monospecificity is thought to be due to the complexity of the ecological needs of the species. (Tyner-Washington)
W70-01471

APPEARANCE OF RED WATER CAUSED BY COCHLODINIUM SP. IN THE BAY OF JUAN-LES-PINS (FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
J. M. Pincemin.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 205-216, 1969. 4 fig, 1 tab, 18 ref.

Descriptors: *Red tide, *Dinoflagellates, Salinity, Water temperature, Nutrient requirements.
Identifiers: *Red water, Causes of red water, Juan-les-Pins, *Cochlodinium sp.

An occurrence of red water containing 30 to 80 million Cochlodinium sp. cells per liter was reported during 4 days of June, 1968, in the Bay of Juan-les-Pins. The mass of seawater containing the organisms was of lower salinity and higher temperature than the surrounding water and had a larger concentration of nutrients. The high concentration of Dinoflagellates is explained by both vertical (positive phototaxis and reduced density) and horizontal (wind) concentration. Culture studies showed that Cochlodinium sp. has highly specialized requirements and that it inhibits Chaetoceros sp. (Tyner-Washington)
W70-01472

LITERATURE REVIEW 1967 (TEMPERATURE).

Journal of Water Pollution Control Federation, Vol 40, No 6, p 1021-1022, 1024-1033, June 1968. 14 ref.

Descriptors: *Temperature, *Fish, *Publications, *Fish behavior, Fish food organisms, *Reviews, Bibliographies.
Identifiers: Cold water discharge, Cold water salmonid streams, Warm water centrarchid environment.

The American literature of 1967 is surveyed on the effects of temperature on fish life. Main topics are acclimation of fish to different temperatures, including standards for temperature regulations for cold water salmonid streams, warm water centrarchid environments, and estuaries. One article is review on cold water discharge. (Rietveld-Vanderbilt)
W70-01474

LITERATURE REVIEW, 1967, (THERMAL POLLUTION - BIOLOGICAL EFFECTS),
C. C. Coutant.
Journal of Water Pollution Control Federation, Vol 40, No 6, p 1047-1052, June 1968. 37 ref.

Descriptors: *Thermal pollution, *Publications, *Fish behavior, *Aquatic life, Thermal power plants, Dissolved oxygen, *Reviews, Bibliographies.

This article reviews the literature of 1967 on the biological effects of thermal pollution. The main topics are the biological problems associated with nuclear power plants, water criteria to protect aquatic life, DO in streams in correlation with thermal pollution, influence of temperature on aquatic life, resistance of cells to high temperature; relationship of water temperature to growth of some fish, preference temperatures of some fish, constructive uses of waste heat from thermal power plants. (Rietveld-Vanderbilt)
W70-01475

ENVIRONMENTAL FACTORS RELATING TO LARGE WATER PLANTS,
Battelle Memorial Inst., Richland, Wash.
H. M. Parker.
Water Production Using Nuclear Energy (Ed by R G Post and R L Seale), p 209-26, 44 ref, Univ Arizona Press, Tucson (1966). (Proc Am Nucl Soc Symp, Mar 1966, Tucson).
Identifiers: *Reviews, *Site selection criteria, *Waste disposal, Algae control, Microorganism control, Saline contamination, Wastes, Water biology.

A state-of-the-art review on the effect of thermal and saline pollution from a large-scale nuclear dual-purpose plant on the marine life in the area around the plant site. Present regulations appear to cover the aspect of the release of radioactive material. However, restrictions on thermal and saline water release are not uniform. Temperature and salinity are two of the most potent physical factors in the life of marine and brackish water organisms, since they largely characterize the physicochemical properties of the medium. There is a complex correlation between the biological effects of temperature and salinity - temperature can modify the effects of salinity, and salinity can modify the effects of temperature. Changes in temperature and salinity alter the physical and chemical properties of water, and organisms react to the total environment. Therefore, detailed effects ascribed to temperature and salinity alone cannot be defined.
W70-01543

AQUATIC WEEDS,
Wisconsin Univ., Madison. Coll. of Agriculture; and Agricultural Research Service, Fort Lauderdale, Fla. Crops Research Div.
L. G. Holm, L. W. Weldon, and R. D. Blackburn.
Science, Vol 166, p 699-709, Nov 1969. 10 fig, 29 ref.

Descriptors: *Aquatic weeds, *Eutrophication, Lakes, Dams, Streams, Vegetation, Rivers, Drainage, Navigation, Water hyacinth, Vectors (Biology), Herbicides, Harbors, Irrigation, Hydroelectric plants, Diseases, Reservoirs, Evapotranspiration, Floods, Florida, Wisconsin, Alabama, Louisiana, Mississippi, Canals, Rice, Watershed management, Shellfish, Bulrush, Cattails, Alligatorweed, Phreatophytes, Cottonwoods, Mesquite, Biocontrol, Water pollution effects, Mechanical equipment, Mosquitoes, Snails, Tilapia.
Identifiers: *Resources management, Infestations, Pistia stratiotes, Eichhornia crassipes, Salvinia auriculata, Africa, Central America, South America, Asia, Australia, New Zealand, Lemnaceae, Cyperus papyrus, Hydrilla.

The supply of both water and soil are limited. Rampant growth of aquatic weeds is symptomatic of the failure to manage resources. Many water sources of Asia and Africa, and of Wisconsin and Florida, are so fertile and so well innoculated with aquatic weeds that they can no longer correct themselves. Using combinations of mechanical, biological (turning nature against itself), and chemical (selective herbicides) methods of control, we can help with the restoration of watercourses. The scourge of some major rivers in water hyacinth, now generally distributed in Africa, and in many lakes, streams, and reservoirs of Central and South America. Floating mats of water fern, with water lettuce, infest Lake Kariba, Africa. These mats serve as host sites for mosquito larvae. Submersed weeds invade waterways rapidly; emersed weeds are troublesome in irrigation and drainage systems, and Phreatophytes waste water of stream channels. Islands of large masses of floating dead aquatic vegetation are impossible to cope with in channels of main streams. Papyrus of African waterways, frequently mixed with a robust grass, is one of the principal plants forming these islands. (Jones-Wisconsin)
W70-01575

NUTRIENT LIMITATION OF SUMMER PHYTOPLANKTON GROWTH IN CAYUGA LAKE,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02H.
W70-01579

PHOSPHATE ADSORPTION AND ISOTOPIC EXCHANGE IN LAKE MUDS,
Copenhagen Univ., Hillerod (Denmark). Freshwater-biological Lab.
For primary bibliographic entry see Field 02H.
W70-01581

CAN ECOLOGY PROVIDE THE BASIS FOR SYNTHESIS,
Wisconsin Univ., Madison. Lab. of Limnology.
For primary bibliographic entry see Field 06F.
W70-01582

LIMNOLOGICAL EFFECTS OF FERTILIZING BARE LAKE, ALASKA,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W70-01583

POLLUTION: A STUDY IN ECOSYSTEM PATHOLOGY,
Federal Water Pollution Control Administration, Washington, D.C. Office of Estuarine Studies.
Harold Berkson.
Preprint of paper presented at meeting of the American Society of Limnology and Oceanography, June 17, 1968, Madison, Wisconsin. 9 p.

Descriptors: *Ecosystems, *Pollution abatement, Water pollution effects, Pesticides, Fishkills, Epidemics, Water pollution control, Eutrophication, Nutrients.
Identifiers: *Environmental quality, *Ecosystem pathology, *Environmental modifications, Nutrient balance, Biological magnification, Genetic alteration, Mercury contamination, Organic hydrocarbons, Minamata disease, Sphaerotilus natans, Nannochloris atomus.

Effects of pollution on aquatic organisms and their ecosystems range from the large scale, well publicized, disasters, such as massive fishkills, down to most subtle changes in the ecosystem. The author cites examples from four categories illustrating the range of pollution effects. (1) Change in the environment, such as additions of high concentrations of toxic substances, DDT for example; introduction of crude oil, and presence of excess silt, which give rise to familiar biological problems of pollution. (2) The environment may be altered by enhancing growth of undesirable organisms, such as Sphaerotilus natans (associated with carbohydrate-containing wastes), and Nannochlorus atomus whose growth is enhanced by nutrient imbalance. (3) 'Biological magnification' refers to substances which are toxic only after passing through a portion of the food chain or at a specific point in an organism's life. (4) Teratogenic effects and genetic alterations; for example, a localized cerebral palsy epidemic in Japan was associated with consumption of fish caught in a bay into which mercury was discharged by a manufacturer. We are able to recognize massive disasters and destroyed ecosystems after the fact, but lack the capability to diagnose incipient problems and predict effects of environmental modification. (Ketelle-Wisconsin)
W70-01584

5D. Waste Treatment Processes

EVAPORATION SYSTEM RECOVERS CHEMICALS FROM PLATING WASTES,
Pfaudler Permutit, Inc., Rochester, N.Y.
J. M. Culotta.
Water and Wastes Engineering, p 62-64, Mar 1967. 4 fig, 1 tab.

Descriptors: *Industrial wastes, *Evaporators, *Heat exchangers, Heat transfer, *Thermal pollution.
Identifiers: *Metal finishing wastes, *Waste heat, Rinse water, Closed loop, Dragout.

Significant advances have been made in handling cyanide and chromic acid plating waste operations by new sophisticated systems that recover the bulk of the wastes by evaporation, and neutralize or chemically destroy only the small fraction which is not economically recoverable. Described are: the closed-loop system, in which a single-effect evaporator concentrates flow from the rinse water holding tank, and the open-loop system. The circulation loop through the evaporator is opened by creating another loop for the cyanides. The dragout solution can be retreated before sewering. An economic table-analysis of this system is given. In the third system, called optimized system, 80-90% of the chromic acid normally lost by dragout is recovered from waste, through evaporation, by utilizing waste heat. This helps prevent thermal pollution also. (Rietveld-Vanderbilt)
W70-01384

THE PRESENT POSITION OF THE EFFLUENT PROBLEM IN SWITZERLAND (IN GERMAN),
F. Adam.
Textil-Rdsch, Vol 9, No 11, p 563-569, 1954.

Descriptors: *Domestic wastes, *Industrial wastes, *Waste water treatment, Treatment facilities, Waste treatment.
Identifiers: Chemical composition, Bleaching wastes, Dyeing wastes, Rayon, Man-made fiber production wastes, Wool washing wastes.

The author deals with the treatment of domestic sewage in biological plants and the effect of industrial waste waters on such plants, and discusses the composition once necessary preliminary treatment of waste waters from bleaching, wool washing, dyeing and rayon manufacture. (Livengood-North Carolina State Univ)
W70-01398

DEVELOPMENT OF NEW REVERSE OSMOSIS MEMBRANES FOR DESALINATION,
North Star Research and Development Inst., Minneapolis, Minn.
For primary bibliographic entry see Field 03A.
W70-01401

THERMOPHYSICAL PROPERTIES OF SALINE WATER,
Monsanto Research Corp., Everett, Mass. Boston Labs.
For primary bibliographic entry see Field 03A.
W70-01402

SELECTIVE ELEMENT RECOVERY FROM OIL FIELD BRINES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02K.
W70-01413

WATER-QUALITY IMPROVEMENT BY GROUND-WATER RECHARGE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Herman Bouwer.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 23-27, 1969. 5 p, 9 ref.

Descriptors: *Artificial recharge, *Waste water treatment, Biodegradation, Soil disposal fields, Denitrification, Water quality, Water chemistry, Water pollution control, Sanitary engineering, Sewage disposal, Water reuse, Groundwater movement.
Identifiers: Water quality improvement.

Aerobic percolation of low-quality water through soil to the water table and subsequent lateral movement below the water table can be effective mechanisms for removing biodegradable material, pathogenic organisms, and certain inorganic substances such as metals from the water. Recharge basins should be managed to avoid accumulation of suspended material on the bottom and to allow sufficient oxygen to enter the soil during dryups to satisfy the total oxygen demand of the water that has entered during inundation. Also, the basins should be so laid out and operated to avoid excessive water-table buildups while at the same time achieving maximum recharge per unit basin area. Nitrogen in the low-quality water will appear mostly as nitrates in the renovated water. For renovated sewage effluent, the nitrate content may be two to four times higher than the permissible limit for drinking water. Nitrate reduction by denitrification or other processes is emerging as a major problem in renovating sewage effluent, and research in this area is being intensified. (Knapp-USGS)
W70-01414

SLUDGE DISPOSAL-AEROBIC AND ANAEROBIC DIGESTION - BASIC CONCEPTS,
L. A. Allen.
Effluent and Water Treatment Manual, Vol 2, No 7, p 388-392, 1962.

Descriptors: *Aerobic treatment, *Anaerobic digestion, *Biodegradation, *Activated sludge, *Treatment facilities, Sludge treatment, SLUDGE DISPOSAL, Biological treatment, Organic matter.

The basic principles of aerobic and anaerobic digestion are discussed and their application to sludge disposal is critically examined. (Goodwin-North Carolina State Univ)
W70-01444

PLANT INSTALLATIONS FOR INDUSTRIAL EFFLUENT TREATMENT,
Ian M. E. Aitken, and Leslie E. Streatfield.
Effluent and Water Treatment Manual, Vol 5, no 5, p 253-256, and p 320-324, 1965. 9 p.

Descriptors: *Sedimentation, *Flotation, *Biological treatment, *Filtration, *Chemical reactions, Treatment facilities, Industrial wastes, Ion-exchange, Sludge treatment, Instrumentation.

A comprehensive report on the importance and necessity today of industries' having an effluent treatment plant that carries out its functions. The article covers treatment methods: 1-Sedimentation, 2-Filtration, 3-Flotation, 4-Chemical reaction (including ion-exchange), 5-Biological action; the sludge problem, abstraction of solids, recirculation, floation methods, instrumentation and automation, and planning plant installations. (Livengood-North Carolina State Univ)
W70-01479

COLLOQUIUM ON WOOL SCOURING. Part 4. WOOL GREASE RECOVERY AND EFFLUENT TREATMENT,
C. A. Anderson.
Textile J Australia Vol, 40, No 4, p 11-14, 1965.

Descriptors: Calcium Chloride, Centrifugation, Emulsions.
Identifiers: *Scouring waste, *Recovery (Waste), *Wool, Wool grease, Aqueous scouring, Solvent scouring, Suint, Acid degredation.

Methods of grease recovery from aqueous wool scour liquors and solvent extraction liquors are compared. (Goodwin-North Carolina State Univ)
W70-01483

CRAZED RESIN FILTRATION OF COMBINED SEWER OVERFLOWS.
Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
For primary bibliographic entry see Field 05G.
W70-01487

SULFIDE TREATMENT OF ACID MINE DRAINAGE.
Bituminous Coal Research, Inc., Monroeville, Pa.

Water Pollution Control Research Series, DAST-2, Nov 1969. 65 p, 6 tab, 9 fig, 41 ref. Available from the Clearinghouse as PB 187 866, $3.00 in paper copy, $0.65 in microfiche. FWPCA Grant No 14010 DLC.

Descriptors: Pollution abatement, Limestones, Hydrogen sulfide, *Sulfides, *Waste water treatment, Stream pollution, *Mine drainage, Coal mine wastes.
Identifiers: *Coal mine drainage, Iron sulfides.

The studies reported herein were a continuation of a 12-month program initiated in June 1967 with funds from the Appalachian Regional Commission. During this earlier program a process for the treatment of coal mine drainage was conceived, involving the combined addition of limestone and hydrogen sulfide to effect precipitation of iron sulfides (LHS process). Results of laboratory-scale continuous flow tests of the LHS process during the current program indicated that hydrogen sulfide feed must be accurately predetermined and controlled to effectively precipitate iron, yet to avoid an excess of reagent in the process effluent. The black sludge formed during treatment undergoes oxidation at a rate depending on drying conditions, with formation of elemental sulfur. X-ray diffraction analyses indicate the iron sulfide sludge component is an amorphous material, although chemical analyses indicate it is initially a stoichiometric compound whose empirical formula corresponds to that of ferrous sulfide. The unstable nature of the sulfide sludge, possibility of polysulfide formation during treatment, instability of mine waters of the type amenable to treatment, and inadequacies of available gas metering equipment are among the factors which militate against the controlled regulation of hydrogen sulfide feed necessary for successful operation of the process. These factors, and additional disadvantages revealed by an updated cost evaluation, lead to the conclusion that the LHS process is less attractive than accepted methods of mine drainage treatment.
W70-01488

AERATED LAGOON HANDLES 10-MILLION GPD.

Textile World, Vol 116, No 2, p 86-87, 1966.

Descriptors: *BOD, Aeration, Lagoons, Hydrogen ion concentration, Waste water treatment.
Identifiers: *Desizing wastes, *Bleaching wastes, *Dyeing wastes, Textile wastes.

The aerated lagoon of Springs Cotton Mills Grace Bleachery is briefly described. (Goodwin-North Carolina State Univ)
W70-01491

AN INDUSTRIAL WASTE GUIDE TO THE WOOL PROCESSING INDUSTRY.

American Dyestuff Report, Vol 44, p 655-661, 1955. 58 p.

Descriptors: *Domestic wastes, *BOD, *Biological treatment, Water pollution effects, Waste treatment, Toxicity, Alkalinity, Detergents, Coagulation, Chemical precipitation, Biodegredation.
Identifiers: *Wool, *Dyeing wastes, *Scouring waste, Textile wastes, Fiber wastes, Recovery (Waste), Acid dyes, Wool grease.

Summarizes the sources of pollution in the wool processing industry, the polluting effects of woolen-mill wastes, and information on the methods of dealing with the waste problems of the industry. (Goodwin and Livengood, North Carolina State Univ)
W70-01493

FFLUENT TREATMENT IN DYEWORKS.

tern Dyer, Vol 134, p 871-873, 1965.

escriptors: Organic matter, Sedimentation.
lentifiers: *Dyeing wastes, *Bleaching wastes, Ef-uent treatment, Biochemical oxidation, Chemical eatment.

his is a brief review of the work reported by the irley Institute in leaflets and at the open-days of e Cotton Silk and Man-Made Fibers Research ssoc. on effluent treatment studies.
70-01495

OW TO TREAT TEXTILE WASTES.

astes Eng, Vol 32, No 1, p 188-189, 1961.

escriptors: *Sludge disposal, *Chemical ecipitation, *Filtration, *Aeration, *Neutraliza-on, *Separation techniques, Waste treatment, otton, BOD, Trickling filters, Biological treat-ent.
lentifiers: *Equalization, Textile wastes.

emarks from two reports: (1) A Simplification of extile Waste Survey and Treatment, by N. En-and Interstate Water Pollution Control Commis-on; and (2) Cotton Textile Industry, by Public ealth Service. Factors to be considered to deter-ine if waste treatment is necessary and which eatment is best.
70-01496

ATEST WORD ON LOW-COST MILL-WASTE ISPOSAL.

extile World, Vol 110, No 6, p 71-75, 1960.

escriptors: *BOD, Waste disposal, Aeration, Al-alinity, Hydrogen Ion Concentration, Lagoons.
lentifiers: *Textile wastes, *Dyeing wastes, Chemical composition, Sulfur dyes, Recovery Waste), Sodium hydroxide.

mphasis is on discharge of mill and dyehouse astes into streams; suggestions are made for han-ling waste by cutting waste volume, changing rocess, separating wastes, building aeration ystem, or using bisorption system.
70-01497

EW ION-EXCHANGE RESINS FOR PURIFY-NG WATER.

ool Record, 107, No 2903, p 35-36, 1965.

escriptors: *Water purification, *Ion-exchange.
lentifiers: Organic poisoning, Anion exchange esins, Polystyrene, Crosslinking, Isoporous struc-ure.

lew resins for use in anion-exchange systems for ater purification are described briefly.
70-01498

RETREATMENT PLANT FOR WOOL FACTO-Y EFFLUENT: WEAR AND TEES RIVER OARD.

ngineer, Vol 214, p 601, 1962.

escriptors: *Treatment facilities, BOD, Calcium hloride, Waste water treatment, Filtration.
lentifiers: *Wool, *Textile wastes, Wool grease.

new technique using calcium chloride as the re-gent reduces the BOD load to about 1500 lb/day is escribed. In operation at Head Wrightson rocesses Ltd., Imperial Chemical Industries Ltd., nd Patons and Baldwins Ltd.
70-01500

PROBLEM OF SISAL EFFLUENT.

Effluent and Water Treat J, Vol 3, p 643, 1963.

Descriptors: Treatment facilities, Separation techniques, Solid wastes, Organic matter, Filtration.
Identifiers: Sisal, Fiber wastes.

A new plant for separating liquid and solid sisal wastes is described.
W70-01501

PROCESS FOR TREATING WATER.

British Patent 955, 321 to Esso Research and Engineering Company. Apr 15, 1946.

Descriptors: *Waste water treatment, *Organic compounds, *Chemical wastes, Treatment facilities, Oxidation, Temperature, Activated carbon, Sewage, Biodegradation, Detergents, Electrodialysis, Absorption, Activated sludge, Foam fractionation, Aeration, Acidity, Carbon dioxide, Solid wastes, Foaming.
Identifiers: Alkylbenzene sulfonates, Dyeing wastes, Solar evaporation.

A process is claimed for removing water-soluble organic compounds from sewage-works effluents and trade waste waters which are free from suspended solids. High-molecular compounds, particularly low concentrations of non-biodegradable water-soluble compounds, such as synthetic detergents, are removed by foam fractionation, and low-molecular organic compounds are then removed by electrodialysis or absorption on activated carbon. A design is also claimed for a treatment plant incorporating an activated sludge unit, foam-fractionation column, and apparatus for collapse of foam by heating or agitation. Effluent from the activated sludge tank is passed to the foam-fractionation column, or, alternatively, if foam is present in the activated-sludge tank it may be skimmed off and passed direct to the foam-collapsing apparatus. Gas is taken from the aeration tank and supplemented with air for use in foaming. Fine bubbles are used and the bubble size and acidity must be controlled carefully. The rate of gassing must be adjusted to maintain a distinct foam-liquid interface and a stable foam must also be maintained (by using a foam column of narrow diameter and, if necessary, adding a small amount of alkylbenzene-sulphonate to increase the foam stability of weakly surface-active contaminants). The collapsed foam can be recirculated to the foam-fractionation column to further concentrate the organic impurities which are subsequently oxidized to carbon dioxide and water at high temperature and pressure. Alternatively, organic compounds, such as phenol, could be recovered from the collapsed foam by solar evaporation. When used to treat secondary sewage effluents, the process removed 87 percent.
W70-01504

REVIEW OF PAPERS PRESENTED AT THE 1965 EFFLUENT AND WATER TREATMENT CONVENTION.

Effluent and Water Treat J, Vol 5, No 3, p 134-136, 1965.

Descriptors: *Legislation, Waste water treatment, Pulp wastes, Treatment facilities, Water pollution control, Evaporation, Electrodialysis, Ion exchange, Sludge disposal, Instrumentation.
Identifiers: Effluent treatment, Textile wastes, Recovery (Waste).

Reviewed are eight articles by the following persons: M. A. Kershaw, A. S. Wisdom, C. Rhodes and others, Ian M. Aitken, T. G. Noble, S. E. Punt and W. J. M. Cook, P. S. A. Northcott, and J. F. Wilkes and H. Kerst. These papers covered water controls, installations, and treatment pertaining to paper mills, textile wastes and other water pollutants.
W70-01505

STREAM POLLUTION REDUCTION PROGRAM FOR FINISHING PLANT.

Textile Ind, Vol 121, No 7, p 71-73, 1957.

Descriptors: *Treatment facilities, *BOD, Waste treatment, Economics, Activated sludge, Toxicity, Flow rates, Fish.
Identifiers: *Bleaching wastes, *Finishing wastes, Starch, Dyeing wastes.

A waste treatment plant and program designed for Hohokus Bleachery is described.
W70-01507

SYMPOSIUM ON WASTE-DISPOSAL PROBLEMS OF SOUTHERN MILLS.

American Dyestuff Reptr, Vol 44, No 12, p 379-400, 1966.

Descriptors: *Legislation, *Standards, *Biological treatment, Pollution abatement, Waste treatment, Alkalinity, Sewage, Water pollution control.
Identifiers: *Bleaching wastes, *Dyeing wastes, *Slashing wastes, Recovery (Waste), Sodium hydroxide.

Papers on Relation of Federal stream pollution to laws and industry, Cotton slashing with synthetic compounds as means toward pollution abatement; Bleaching and dyehouse waste studies; Textile waste treatment in Texas; Biological treatment of mixture of highly alkaline textile-mill waste and sewage; Classification of streams in Georgia, South Carolina and North Carolina; Pollution control by recovery of caustic soda.
W70-01508

TEXTILE WASTE DISPOSAL SYMPOSIUM.

American Dyestuff Reptr, Vol 47, No 14, p P473-P491, 1958.

Descriptors: *Domestic wastes, *BOD, Water pollution control, Waste disposal, Cotton, Coagulation, Biological treatment, Hydrogen-Ion concentration, Trickling filters, Standards, Toxicity, Waste water treatment.
Identifiers: *Scouring waste, *Slashing wastes, *Desizing wastes, *Bleaching wastes, Finishing wastes, Mercerizing wastes, Starch, Wool, CMC, Sodium hydroxide.

Papers are presented on Disposal of combined textile finishing wastes and domestic sewage; Pollution control of New England Interstate Waters.
W70-01510

THE BOD OF TEXTILE CHEMICALS: UPDATED LIST - 1966.

American Dyestuff Reptr, Vol 55, p P685-688, 1966. 9 refs.

Descriptors: *Biochemical oxygen demand, Bio degradation, Test procedures.
Identifiers: *Textile chemicals, Chemical composition.

RA58 Stream Sanitation Technol. AATCC Committee. The list gives (1) name of chemical, (2) 5-day BOD, %, (3) references, (4) chemical composition and use.
W70-01511

THE SECOND INTERNATIONAL MAN-MADE FIBRE SYMPOSIUM - 1965 IN BERLIN (IN GERMAN).

Faserforsch, u. Textiltech, Vol 16, No 7, p 363-371, 1965.

Descriptors: Conferences.
Identifiers: Effluent treatment, Man-made fiber production wastes.

Short reports of the following papers are published together: 'The polymerization of w-aminocarboxylic acid lactams' by P. Schlack; 'Reaction mechanisms in polyethylene terephthalate melts' by B. Zimmermann and others; 'Fibre formation from polypropylene and modified polypropylene' by F. Geleji and others; 'A study of stretching processes in polypropylene' by M. Jambrich, I. Diacik, and P. Hravnak; 'The influence of processing and finishing on glass fibre properties' by W. Bobeth, R. Barthel, and G. Wiedemann; 'Two structural classes among man-made fibres' by N. V. Michajlov; 'The paracrystalline fibrillar structure in polyethylene which has been drawn and tempered by various methods' by R. Hosemann, R. J. Balta Celleja, and W. Wilke; 'An investigation of the supermolecular structure of man-made fibres' by A. B. Paksver and L. S. Gerasimova; 'The state of solution of high polymers' by C. Ruscher; 'New studies on the solution state in cellulose solutions' by J. Schurz; 'Physico - chemical studies of the supermolecular structure of high strength regenerated cellulose fibres' by B. Philipp and J. Baudisch; 'Investigations of structural changes in cellulose during the viscose process, with the aid of deuterium exchange and infrared techniques' by G. Wlodarski; 'Possible methods of structure formation in regenerated cellulose fibres' by V. Beseda, M. Kozler, and F. Lauko; 'Kinetic studies on the break-down of xanthic acids' by Z. Cichowski; 'The normal solution properties of viscose with respect to ultra filtration and flocculation behavior by A. Matthew, A. Grundling, and M. Rosezberg. (Goodwin and Livengood-North Carolina State Univ)
W70-01512

WASTE WATERS FROM THE WASHING OF WOOL.

Bull Mens Centre Belge et Document. Eaux, No 71, p 432-434, 1956.

Descriptors: *Waste water treatment.
Identifiers: *Scouring waste, *Wool, Lanolin.

In connection with the recent Commission dealing with the purification of the River Vesdre, Belgium, and the problems of lanolin in this river; a brief summary is given of work on similar problems in New England and details are given of the method of treating wool scouring waste waters. (Goodwin and Livengood-North Carolina State Univ)
W70-01513

WATER AND EFFLUENTS.

Intern Dyer, Vol 136, p 916-918, 1966.

Descriptors: *Biochemical Oxygen Demand, Water, Alkalinity, Acidity, Biochemical treatment, Activated sludge, Anaerobic digestion, Standards, Ion exchange, Economics, Hardness (Water).
Identifiers: *Catonic surfactants, *Noidnic surfactants, *Anionic surfactants, *Dyeing wastes, Percolating filters, Dye house, Effluent treatment.

Summaries are given of the following papers presented at a half-day symposium by the London Region of the Soc. of Dyers and Colourists on November 4, 1966: (1) Water for the dyehouse, by T. H. Morton; (2) Water usage in rinsing, by G. J. Parish; (3) Surface-active agents in processes and effluents, by W. V. Barnes and S. Dobson; and (4) Treatment of effluents, by A. H. Little. (Goodwin and Livengood-North Carolina State Univ)
W70-01514

PLASTICS IN WASTE TREATMENT,
M. W. Askew.
Process Biochem, Vol 1, p 483-486, 492, 1966; Vol 2, p 31-34, 1967.

Descriptors: *Standards, *Waste treatment, *Plastics, *Filtration, Activated sludge, Waste water treatment, Foods.
Identifiers: Polyvinyls.

The author discusses the standards for trade effluent imposed and expected in Europe, Canada and U.S.A. As a result of these higher standards new methods of treatment have been devised using polyvinyl chloride corrugated-sheeting units which can be used in place of established biological filtration media, where cost, space and technical problems make the use of activated-sluge tanks and other conventional methods impracticable. The characteristics of Flocor medium and its advantages over conventional filter media are described and examples are given of its use to treat waste waters from distilleries, breweries, fruit and vegetable processing, and textile plants. (Livengood-North Carolina State Univ)
W70-01515

STUDY OF DYEWORKS WASTE WATERS (IN FRENCH),
R. Baetsle.
Bull Mens Centre Belge et Document, Eau, No 27, p 16-29, 1955.

Descriptors: *Water analysis, Cotton, Water supply, Waste water (Pollution), Water pollution effects, Waste water treatment.
Identifiers: *Dyeing wastes, *Chemical composition.

Taking two examples of dye works associated with the cotton industry results are shown in tables of physical and chemical analyses of water supply and waste waters in each case. The effects of discharge of waste waters on the receiving rivers are also illustrated by means of tables and possible methods of treatments are discussed. (Livengood-North Carolina State Univ)
W70-01517

MECHANISM OF STARCH REMOVAL IN THE ACTIVATED SLUDGE PROCESS,
Delaware Univ., Newark; and Illinois Univ., Urbana.
S. K. Bannerji, B. B. Ewing, R. S. Englebrecht, and R. E. Speece.
J Water Pollution Control Fed, Vol 40, No 1, p 16-29, Jan 1968.

Descriptors: *Activated sludge, *Biodegradation, Colloids, Waste water treatment, Biological treatment, COD, Enzymes.
Identifiers: *Starch, Desizing wastes.

A laboratory experiment on the removal of colloidal wastes from wastewater (e.g., starch from textile desizing processes) is reported. An explanation of the mechanisms involved in removal of potato starch by activated sludge is offered. (Goodwin and Livengood-North Carolina State Univ)
W70-01518

ADSORPTIVE REMOVAL OF AROMATIC COMPOUNDS FROM THE WASTE WATERS OF ANILINE DYE WORKS (IN RUSSIAN),
R. M. Bekher.
Ukrain Khim Zhur, Vol 27, p 268-273, 1961.

Descriptors: *Activated carbon, *Waste water treatment, Adsorption, Phenols, Separation techniques.
Identifiers: *Dyeing wastes, *Aniline black dyes, Benzene, Toluene.

An absorption method for treating aniline dye manufacture waste waters with activated C (KAD) is described in which the mononitro-derivative of benzene, chlorobenzene, toluene, phenol, and cresol, dinitrochlorobenzene, p-nitrophenol and 2, 4, 5 trichlorophenol are removed. Methods for regenerating the charcoal and separating the contaminants are discussed briefly and the adsorption capacity and required period of contact for each material are quoted, with details of results achieved. (Livengood-North Carolina State Univ)
W70-01520

DISPOSAL OF SEWAGE EFFLUENT AT MADISON, WIS,
Madison Metropolitan Sewerage District, Wis.
H. O. Lord.
Sewage and Industrial Wastes, Vol 22, No 1, Jan 1950. 1 fig.

Descriptors: *Sewage effluent, *Legal aspects, *Legislation, Sanitray districts, Chemical precipitation, Trickling filters, Activated sludge, Nitrogen, Phosphorus, Wisconsin, Water pollution sources, Water pollution effects, Waste treatment, Nutrients, Eutrophication.
Identifiers: *Effluent disposal, *Madison (Wis), *Treatment requirements, Nuisance conditions, Algal growth, Nutrient sources, Lake investigations, Court orders, Effluent quality, Lake Mendota (Wis), Lake Monona (Wis), Lake Kegonsa (Wis), Lake Waubesa (Wis), Yahara River (Wis).

An historical account is presented of disposal of sewage effluents at Madison, Wisconsin, from 1884 (when sanitary districts served by public sewers were first developed) to 1950. In 1898, the first sewage treatment began, utilizing chemical precipitation. In 1901, a trickling filter plant replaced the original unit. Activated sludge treatment was inaugurated in 1914. Population growth by 1928 necessitated addition of a second plant and several subsequent modifications. Nuisance conditions have long been attributed to the lakes' overenrichment with sewage effluents. A committee, appointed by the Governor in 1941, to study the Madison lakes, proposed that removal of nitrogen and phosphorus from effluents would significantly contribute to abatement of the nuisance conditions. The legislature enacted a law in 1943, prohibiting discharge of sewage effluents into lakes (apparently tailored specifically for the Madison area). An order by the State Board of Health, requiring Madison's sewage effluent to be discharged outside the drainage basin, was found unlawful and reversed after judicial review in 1948. The original 1943 law was amended in 1949 to permit exemption from the requirement if adequate treatment was provided. (Ketelle-Wisconsin)
W70-01580

5E. Ultimate Disposal of Wastes

SOIL SEALING CHEMICALS AND TECHNIQUES,
Diamond Shamrock Corp., Painesville, Ohio. T. R. Evans Research Center.
J. J. Mannion, and D. J. Porter.
Available from the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402, for $0.40 per copy. Office Saline Water Res and Develop Progr Rep No 381, 1968. 31 p, 4 fig, 11 tab. Contract No 14-01-0001-1289 OSW.

Descriptors: *Soil sealants, *Analytical techniques, *Waste water disposal, Brines, Lignins, Soil moisture, Permeability, Permeameters, Cost analysis, Cellulose, Additives, Research and development.
Identifiers: *Lignin derivatives, Sodium chromate, Alum, Carboxymethyl cellulose, Petroleum emulsions.

Materials to be used in making soils impermeable to concentrated brine for disposal by evaporation were studied. Roswell soil from New Mexico was rendered impervious by four classes of additives, namely, lignin derivatives gelled with sodium chromate or alum, carboxymethyl cellulose with alum, petroleum emulsions, and an attapulgite clay. Soil permeability was sensitive to moisture content. This relationship should be considered in research experiments with additives and in field installation procedures. The reproducibility of results in small permeameters was not as good as expected because of insufficient control of moisture levels. Permeability tests of longer duration need to be made before any major installation is contemplated. A graphical technique for comparing treatment costs and effectiveness is suggested. The additive cost for

reducing the seepage at Roswell to less than 6 inches per year at a brine depth of 20 feet by treating a 6-inch soil layer can be as low as $500 per acre. A graphical technique for comparing treatment costs and effectiveness is suggested. (Carstea-USGS)
W70-01273

BEACHES.
For primary bibliographic entry see Field 06E.
W70-01310

A STUDY OF DEEP WELL DISPOSAL OF DESALINATION BRINE WASTE,
Dow Chemical Co., Freeport, Tex.
P. G. LeGros, C. E. Gustafson, G. L. Nevill, E. C. Majeske, and R. D. Mathews.
Offc of Saline Water Research and Development Progress Report No 456. June 1969. 259 p. OSW Contract 14-01-0001-1691.

Descriptors: *Brine disposal, *Brines, *Saline water, *Deep wells, *Injection wells, Waste disposal, Subsurface investigations, Desalination.
Identifiers: *Deep well disposal, Deep well usage, Geologic considerations, Desalting.

Seven inland U.S. communities were selected as examples for the design of deep well disposal facilities for the desalination waste brines. The water needs, the geological structures, and other pertinent data were accumulated for each of the seven communities. Actual values were used wherever available. Injection wells and surface equipment were designed for each community, and estimates were made of the cost of construction and operation of the designed disposal system in each. The developed costs vary from a low of 2.5 cents per 1000 gallons of product water at Arkansas City to a high of 35.1 cents at Fort Morgan. This spread in costs represents the expected ranges due to variations in geology, geography and plant size. (Gransee-Office of Saline Water)
W70-01480

5F. Water Treatment and Quality Alteration

DEVELOPMENT OF NEW REVERSE OSMOSIS MEMBRANES FOR DESALINATION,
North Star Research and Development Inst., Minneapolis, Minn.
For primary bibliographic entry see Field 03A.
W70-01401

DISPOSAL OF INDUSTRIAL WASTE MATERIALS.

Society of Chem Ind, London, 1957. 157 p.

Descriptors: *Detergents, Industrial wastes, Waste disposal, Surfactants, Cotton.
Identifiers: *Fiber wastes, *Man-made fiber production wastes, *Bleaching wastes, Dyeing wastes, *Finishing wastes, *Printing wastes, Wool, Silk, Rayon, Acetate.

These are papers read at the conference at Sheffield University, April 17-19, 1956, with the discussions that followed.
W70-01494

1966 BOOK OF ASTM STANDARDS. INDUSTRIAL WATER: ATMOSPHERIC ANALYSIS.

Am Soc for Testing and Materials, p 878, 1966.

Descriptors: *Ion exchange, Standards, Industrial wastes, Water analysis.
Identifiers: Chemical composition.

ASTM standards relating to industrial water, industrial waste water, and atmospheric analysis are included.
W70-01499

PROCEEDINGS OF THE THIRTEENTH SOUTHERN MUNICIPAL AND INDUSTRIAL WASTE CONFERENCE.

Duke University, Durham, NC, p 212, April 16 and 17, 1964.

Descriptors: *Standards, *Legislation, *Biological treatment, *Aeration, *Dissolved oxygen, Water resources, Water pollution control, Hydrogen ion concentration, Oxygen sag, Surface waters, Kinetics, BOD, Activated sludge, Color, Canners, Cotton.
Identifiers: Textile wastes, Wool, Water tracing techniques.

Of textile interest are a symposium (an appraisal of regulatory statutes relating to control of pollution) and the following paper: 'Interrelationships Among Water Resources, Pollution Control, and Growth of the Textile Industry in the Southeast' (35 refs.), by T. A. Alspaugh, p. 167-203.
W70-01502

PROCEEDINGS OF THE 21ST INDUSTRIAL WASTE CONFERENCE.

Purdue University and Ind State Board of Health. May 3-5, 1966. Purdue University, Lafayette, Ind, p 1017.

Descriptors: *Activated sludge, *Foam - separation, Industrial wastes, Conferences, Biological treatment, Waste water treatment, Synthetic polymers, Biodegredation, Coagulation, Flocculation, COD.
Identifiers: *Starch, *Recovery (Waste), *Sodium hydroxide, *Man-made fiber production wastes, Proteins, Textile wastes, Keratin, Molecular structure, Mercerizing wastes.

The following papers of particular interest to the textile industry are included: (1) 'Biological Treatment of Waste Water from Synthetic Resin Manufacture' by K. G. Singleton (Ciba (A.R.L.) Ltd.,). P><=+. (2) 'Mechanism of Starch Removal in Activated Sludge Process' by S. K. Banerji, B. B. Ewing, R. S. Engelbrecht, and R. E. Speece, p. 84-102. (3) 'Sodium Hydroxide Recovery in the Textile Industry' by C. S. Carrique and L. U. Jaurequi (Univ. of Buenos Aires), p. 861-868. (4) 'Utilization of Resistant Proteins (e.g. Keratin) by Activated Sludge' by G. J. Capestany (Municipality of Metropolitan Seattle) and D. A. Carlson (Univ. of Washington), p. 943-952.
W70-01503

TEXTILE EFFLUENT TREATMENT AND DISPOSAL.

Cotton Silk and Man-made Fibres Research Association, Manchester (Shirley Institute Pamphlet No 92) p 92, 1966.

Descriptors: *Waste disposal, *Waste water treatment, *Legislation, *Standards, Surface waters, Self-purification, Flow rate, BOD, COD, Cotton, Sedimentation, Chemical precipitation, Biological treatment, Anaerobic digestion, Aerobic treatment.
Identifiers: *Fiber-production wastes, Effluent treatment, Textile wastes, Chemical composition, Wool.

Papers read at a conference on 17th November, 1965, are presented: 'Planning for Trade-Effluent Disposal' by P. C. G. Isaac (pp. 9-34), 'Treatment of Waste Waters from the Textile Industry' by A. B. Wheatland (pp. 35-59), 'Pollution by Textile Effluents in the Mersey Basin' by C. Lumb (pp. 60-76), and 'Stratification in Sedimentation Tanks' by A. H. Little (pp. 77-92).
W70-01509

ZINC RECOVERY FROM VISCOSE RAYON EFFLUENT,
R. S. Aston.
Ont Ind Waste Conf, Proc No 13, p 215-230, 1966.

Descriptors: Ion exchange, Evaporation.
Identifiers: *Recovery (Waste), *Zinc sulfate, *Rayon, *Man-made fiber production wastes, Zinc compounds, Sulfuric acid, Cationic exchange resins.

The recovery of Zn, in the form of $ZnSO_4$, by ion exchange was successfully applied to the treatment of effluent liquors from a viscose rayon plant. The resin used was Permutit Q, a cation exchanger of the sulfonated polystyrene type, operating in the H cycle and regenerated with H_2SO_4. The process is more effective than an evapn. process in reducing the Zn pollution content, since large vols. contg. a low concn, may be treated. The tech. and economic feasibility is enhanced at plants that produce different types of viscose yarn. At the Cornwall plant of Courtauls (Canada) Ltd., the Zn discharge to the river was reduced by 80%. (Livengood-North Carolina State Univ)
W70-01516

PRACTICAL ASPECTS OF THE DESIGN OF WASTE STABILIZATION PONDS,
W. D. Barlow.
Proc 9th Sth Munic Industr Waste Conf, p 65-70, 1960.

Descriptors: *Lagoons, *Domestic wastes, Waste water treatment, Industrial wastes, Neutrients, Bacteria, Algae, Treatment facilities, Test procedures, Metals.
Identifiers: *Finishing wastes.

Lagoons can be designed to provide complete treatment for any waste water, domestic and/or industrial, provided it contains the necessary nutrients and is free from substances which are toxic to bacteria or algae. The author discusses the basic processes involved; factors affecting the design and operation of the lagoon (particularly under conditions in North and South Carolina); performance of the lagoon, including methods of measurement; and precautions to be taken to avoid health hazards, pollution and other nuisance problems. In discussion, reference was made to lagoons used for treating mixed waste waters and 20-30 per cent of domestic sewage, and especially to the problems encountered which appear to be caused by toxic metals in the waste water. (Livengood-North Carolina State Univ)
W70-01519

5G. Water Quality Control

WATER SUPPLY IN COLD REGIONS,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02C.
W70-01259

WATER POLLUTION CONTROL.

Ky Rev Stat Ann secs 224.010-224.130 (Supp 1968).

Descriptors: *Pollution, *Kentucky, *Water pollution control, *Standards, Waste treatment, Administrative agencies, Local governments, State governments, Damages, Permits, Control, Legal aspects, Legislation, Waste disposal, Fish, Fish stocking, Interstate compacts, Water pollution, Water pollution sources, Permits, Abatement, Water management, Water law, Water quality control, United States.

Kentucky has provided a program for the establishment and enforcement of standards concerning water pollution. A Water Pollution Control Commission is established to preserve the waters of the state for the use of the public, to protect fish and

wildlife, and to prohibit water pollution. The Commission shall issue permits providing for construction or modification of disposal systems. By regulating these permits, the Commission is able to control who has rights of disposal and how much they may dispose. The state is empowered to sue to recover costs for restocking and restoring fish and wildlife which are destroyed as a result of illegal disposal activities. The Ohio River Valley Water Sanitation Compact is accepted and enacted into law. This Compact provides for an interstate effort to establish standards and regulate pollution of the Ohio River Valley. (Darragh-Florida)
W70-01307

WATER POLLUTION CONTROL.
Ky Rev Stat Ann secs 224.010-224.040 (Supp 1968).

Descriptors: *Kentucky, *Water pollution, *Administrative agencies, *Water resources development, Federal government, Waste disposal, Waste water disposal, Planning, Legislation, Coordination, Water quality, Water pollution control, Standards, Regulation, Permits, Investigations, Benefits, Water treatment.

It is the policy and purpose of the state of Kentucky to conserve its water resources, to provide for the prevention of pollution, and to cooperate with all federal programs to these ends. To further these purposes, a Water Pollution Control Commission is established within the Department of Health. The Commission may exercise authority, power, and duties concerning: (1) furtherance of the aims of this act; (2) development of a comprehensive plan for control of pollution; (3) cooperation with all relevant federal agencies; (4) conducting studies relating to water pollution; (5) establishment of water quality standards; (6) establishment of rules and regulation for pollution control; (7) issuance of orders of abatement; (8) examination of all plans for construction of disposal systems; (9) regulation of permits for waste disposal; (10) conducting investigations; (11) institution of proceedings to force compliance; and (12) taking necessary action to secure the benefits available under the Federal Water Pollution Control Act. (Darragh-Florida)
W70-01308

WATER POLLUTION CONTROL.
Ky Rev Stat Ann secs 224.060-224.130 (Supp 1968).

Descriptors: *Waste treatment, *Pollution, *Kentucky, *Water pollution control, Administrative agencies, Local governments, Damages, Permits, Legislation, Interstate compacts, Waste disposal, Fish, Fish stocking, Standards, Regulation, Legal aspects, Water pollution, Water treatment, Water quality, Pollution abatement, Pollutant identification, Fish kill.

It shall be unlawful for any person to discharge any waste into the waters of the Commonwealth in contravention of the standards established by the Water Pollution Control Commission. No new source of discharge or any proposed change in any old source of discharge may be made without first obtaining a permit from this Commission. No establishment may be changed so as to cause a substantial increase in the discharge of waste without first obtaining a permit. If between meetings of the Commission the executive director finds that an emergency exists, he may ask the Governor to issue an appropriate order. Public hearings shall be held concerning the issuance of permits. Orders to control pollution will be issued at such hearings. Where injury, death, or destruction results to fish from pollution activities, the persons responsible for such pollution shall be liable for the cost of restocking or replenishing such fish. The Ohio River Valley Water Sanitation Compact, which was adopted to reduce and control pollution of the Ohio River, is approved and enacted into law. (Darragh-Florida)
W70-01309

SAMPLING FOR WATER POLLUTION.
Va Code Ann 29-35.1, 29-35.2 (1969).

Descriptors: *Virginia, *Water pollution, *Pollution abatement, *Water pollution control, Water pollution treatment, Pollutant identification, Analytical techniques, Chemical analysis, Cities, Streams, Sampling, Administrative agencies, Water law, Legal aspects, Legislation.

Any game warden may be requested by a member of the governing body of a county, city, or town to take samples from any stream believed to be polluted. The warden sends the sealed sample and a report of pertinent circumstances to the State Water Control Board. If on chemical analysis the water is found to be polluted, the Board has further studies and analyses performed to determine the nature and extent of such pollution and the most effective measures for controlling the same. (McDonough-Florida)
W70-01312

WATERS OF THE STATE: REGULATION OF INDUSTRIAL ESTABLISHMENTS.
Va Code Ann secs 62.1-28 thru 62.1-30 (1968).

Descriptors: *Virginia, *Water pollution, *Industrial wastes, *Water pollution control, Abatement, Pollution effects, Non-structural alternatives, Pollutants, Water pollution treatment, Water quality control, Water pollution sources, Wastes, Pollution abatement, Disposal, Legal aspects, Legislation, State governments.

Any owner of an industrial establishment which, in its operation, would cause pollution of the state's waters must provide facilities for treatment of industrial wastes or take such measures as will prevent pollution before operation of the establishment may commence. Any owner proposing to discharge industrial wastes or otherwise alter the physical, chemical, or biological properties of state waters must secure a permit from the State Water Control Board. Any owner who handles, stores, distributes, or produces other wastes shall, upon request of the Board, install facilities or adopt procedures approved by the Board as are necessary to prevent the discharge or escape of pollutants into state waters. (Kelly-Florida)
W70-01319

PROHIBITION OF WATER POLLUTION.
R I Gen Laws Ann secs 46-12-4 thru 46-12-7 (Supp 1968).

Descriptors: *Rhode Island, *Water pollution control, *Administrative agencies, Water pollution treatment, Wastes, Sewage, Sewage treatment, Pollution abatement, Water quality control, Investigations, Industrial wastes, Water pollution sources, Water pollution effects, Legislation, Legal aspects, Administration, Supervisory control (Power).

No person may cause or place sewage in a location likely to cause pollution of the state's waters. The statute prohibits construction or modification of sewage disposal systems, activities increasing the volume or strength of present sewage discharge, and construction of any industrial or commercial establishment whose operation may result in discharge of sewage, unless these actions have the approval of the Director of the Department of Health. If the Director believes that a violation of the chapter is taking place, he must initiate an investigation. Evidentiary hearings are required before violation may be found to exist. The Director may employ such professional or expert services as he requires to aid in investigation or prosecution of a suspected violation. (Kelly-Florida)
W70-01328

ADOPTION OF APPROVED POLLUTION PREVENTION SYSTEMS.
RI Gen Laws Ann secs 46-12-8 thru 46-12-15 (Supp 1968).

Descriptors: *Rhode Island, *Water pollution control, *Adoption of practices, *Pollution abatement, Sewage treatment, Water pollution treatment, Project planning, Planning, Water quality control, Water pollution effects, Water pollution sources, Administrative agencies, Administration, Public health, Legal aspects, Legislation, Supervisory control (Power).
Identifiers: Penalties (Criminal).

The Director of the Department of Health may order any person who is polluting the waters of the state to adopt a practicable and reasonably available system or means to prevent such pollution. If more than one system is available, an option may be given. The time limit for adoption of such system is fixed by the Director, but is subject to modification upon application by the person subject to the order. The operation of a pollution control system approved by the Director is sufficient to constitute compliance with all orders issued by the Director during his term in office. Violation of an order of the Director is punishable by fine and/or imprisonment; each day of violation is considered a separate offense. The Director has the power to inspect and to make orders regulating the means and devices utilized by all vessels and land installations for handling petroleum, gasoline, kerosene, tar, oil, or any mixture thereof for the purpose of preventing the discharge or escape of such substances into the waters of the state. (Kelly-Florida)
W70-01329

DISCHARGE OF SEWAGE.

RI Gen Laws Ann secs 46-12-24, 46-12-25, 46-12-33 (Supp 1968).

Descriptors: *Rhode Island, *Sewage treatment, *Water pollution control, *Pollution abatement, Disposal, Wastes, Local governments, State jurisdiction, Construction, Construction costs, Cost allocation, Grants, Federal government, Administrative agencies, Administration, Water pollution treatment, Water pollution sources, Legislation, Legal aspects.

The Director of the Department of Health may consult with and advise any person who discharges or empties sewage into the waters of the state as to the best method to prevent such sewage from polluting those waters. At the Director's request, any person now having a sewer or drain discharging into state waters or upon the beaches thereof must submit a statement describing all such sewers and drains owned or controlled by him together with a description of any works or methods employed to purify or otherwise alter the character of the sewage. Such statements shall be confidential unless made by a municipal corporation. The Director is authorized to grant state funds to municipalities, districts, and agencies for the construction of necessary facilities to prevent the discharge of untreated or inadequately treated sewage into state waters. The grants can be made only for projects which qualify under the Federal Water Pollution Control Act, and only when the director has been informed of project specifications. (Kelly-Florida)
W70-01330

WATER POLLUTION CONTROL.
RI Gen Laws Ann secs 46-12-30, 46-12-32 (1956).

Descriptors: *Rhode Island, *Water pollution control, *Impaired water quality, *Cities, Financing, Administrative agencies, Regulation, Control, Legislation, Local governments, State governments, Ice, Legal aspects, Water quality control, Water pollution, Public health, Standards, Water quality, Planning.
Identifiers: Drinking water, Ice supply.

No person shall be held to have violated the provisions of this chapter where the sole damage caused by him is the rendering unsuitable for drinking purposes or ice supply the waters polluted by him. Town and city councils may expend money to pay

for pollution control in their town or city, and may raise such money by the issue of interest-bearing notes. However, before the issuance of such notes, all plans and specifications for water pollution control must be submitted to and receive the approval of the State Department of Health. (Marsee-Florida)
W70-01331

THE ABATEMENT OF POLLUTION.
Council of Economic Advisors, Washington, D.C.

Controlling Pollution the Economics of a Cleaner America, edited by M I Goldman, Englewood Cliffs, Prentice-Hall, p 171-175, 1967. 5 p.

Descriptors: *Waste treatment, *Pollution abatement, *Federal Government, *Water pollution, *Water quality, Effluents, Waste discharge, Population, Air pollution, Sewerage, Rivers, Fishing, Agriculture, Economics, Economic incentives.
Identifiers: *Water Pollution Control Act, Garbage, Junk automobiles.

This article indicates the federal government's view of the problem of pollution abatement and its current and future role in such abatement. Government already provides for waste disposal and collection and disposal of water-borne wastes. An incentive system to abate waste discharges is proposed as a further measure in the form of taxes or charges levied on a pollutor. Water quality standards must be federally enforced if such pollution endangers the health or welfare of the public. Control agencies should then propose, and legally insist on, remedial measures for such situations. The recent establishment of the Water Pollution Control Administration is expected to facilitate these goals and the act which established the Administration also provides for technical assistance for waste treatment facilities, although financial aid has been limited. The federal government's role should be shouldered by localities, states, corporations and individuals if pollution abatement is to be successful. (Murphy-Rutgers)
W70-01349

MANAGING WATER QUALITY: ECONOMICS, TECHNOLOGY, INSTITUTIONS,
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese, and Blair T. Bower.
Baltimore, Maryland, The Johns Hopkins Press, 328p, 1968.

Descriptors: *Costs, *Government, *Resource allocation, Water quality, Sewage, Aesthetics, Industrial wastes, Filtration, Aeration, Effluents, Reservoirs, Computers, Capital costs, Damages, Biochemical oxygen demand, Degradation, Marginal costs, Dissolved oxygen, Groundwater aquifers, Legal aspects, Organic wastes, Chloride, Delaware, Domestic wastes, Irrigation thermal properties, Recreation.
Identifiers: *Potomac, Damage functions, Degradable wastes, Petroleum refineries.

The book attemps to determine: the quality of water we want to maintain in our watercourses, both surface and underground; the most efficient system of management measures for achieving the specified patterns of water quality and the best institutional or organizational arrangements for managing water quality. It makes use of the economic theory of resources allocation, and case studies of a number of actual situations are presented. The study begins by providing background information on some scientific and technological aspects of water quality. Major wastes, their effects and cost of treatment are analyzed, as well as factors influencing their generation. The theory of economic resource allocation as related to the problems of costs, value and public policy are discussed. A major section focuses on the concept of regional water quality management and the criteria for an economically optimal system of waste disposal. The experiences of some countries are outlined. The last section attempts to draw out the implications of points made for policy in the United States. (Murphy-Rutgers)
W70-01361

REPLY ON COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL',
Oregon State Univ., Corvallis.
Joe B. Stevens.
Water Resources Research, Vol 5, No 4, p 908-909, August 1969. 2p, 2 ref.

Descriptors: *Water pollution control, *Water pollution, *Benefits, Fishing, Demand, Supply, Recreation demand, Social values, Costs, Pricing.
Identifiers: *Recreation benefits, Angler behavior, Consumer surplus, Willingness to pay, Gross social value, Net social value, Producers' surplus, Optimum pricing.

Stevens in this reply concedes that his attempt to separate supply and demand functions for anglers in his fishery case was unsuccessful. Having made certain amendments he suggests that the difference between his argument and Burt's is not great. As to the matter of gross or net measures of social value, Stevens claims that it all depends on when one deducts the costs of pollution control. Stevens is in basic agreement with Burt's suggestion that producers' surplus as well as consumers' surplus be considered in determining net social value of recreation resources. He suggests that the literature in the area is in need of an expanded form of the model which Burt presents. As an inducement for Burt to expand his model, Stevens poses three problems for consideration. The first is the meaning of producers surplus when government, rather than profit seekers, produces the service. Secondly, how is optimum pricing defined when the cost relationship in its marginal form is declining and approaches the quantity axis asymptotically. Third, under what conditions would consumers' plus producers' surplus overestimate the value of recreation resources relative to competing uses where market prices are more readily obtainable. The author, as an addendum, points out an error in his original article in his estimates of income elasticities. (Loeb-Rutgers)
W70-01373

RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
Department of Health, Education, and Welfare, Philadelphia, Pa.
Robert V. Thomann.
Water Resources Research, Vol 1, No 3, p 349-359, Third Quarter 1965. 11p, 4 fig, 1 tab, 4 ref.

Descriptors: *Mathematical models, *Water pollution control, *Water pollution, Mathematical studies, Environment, Systems analysis, Dissolved oxygen, Water quality control, Water quality, Temperature.
Identifiers: *Delaware Estuary, External environment, Waste discharge.

This paper presents the basic principles involved in the construction of a mathematical model of dissolved oxygen in the Delaware Estuary. An attempt is made to introduce these principles with a minimum of mathematics and then to indicate how the mathematical model can be used to generate useful water quality control information. As such, the basic concepts of systems analysis and optimum (least-cost) water pollution control are presented. The basic motivation for the approach is provided by the Public Health Services' Delaware Estuary Comprehensive Study. This investigation is charged with developing a comprehensive water pollution control plan for water quality improvement in the Delaware Estuary. The basic objectives of formulating the Delaware system in mathematical terms were (1) to develop an evaluation of the cause and effect relationships between the external environment and the quality of water and (2) to utilize a portion of this evaluation to develop a rational approach to the attainment of various water quality goals. Both these objectives are indispensable to the techniques of comprehensive planning. (Loeb-Rutgers)
W70-01380

STUDIES ON THE LONGITUDINAL MIXING IN OPEN CHANNELS AND ITS EFFECT ON THE RATE OF THE B.O.D. REACTION IN AQUEOUS MEDIA (IN CZECH),
Hydraulic Research Inst., Prague (Czechoslovakia).
A. Nejedly, and J. Pelz.
Summaries in English and Russian. Vyzkumny ustav vodohospodarksy, Prace a studie, No 112, 1964. 116 p.

Descriptors: *Mixing, *Biochemical oxygen demand, Self-purification, Turbulence, Biochemistry, Decomposing organic matter, Laminar flow, Turbulent flow, Velocity, Flumes, Laboratory tests, Hydraulics equipment, Hydraulic models.
Identifiers: Longitudinal mixing.

It is pointed out that high values of the deoxygenation coefficient occur not only in small streams but also in large rivers. Therefore, the approach utilizing the indirect relationship of the deoxygenation coefficient to the depth of water is not generally valid. The authors submit their own proposal for a possible explanation of the difference between the rate of the BOD reaction under laboratory and field conditions. Under laboratory conditions, all particles of the aqueous medium are subjected to incubation simultaneously and for the same duration of time and therefore cannot interact. The unlimited body of water under stream conditions is subjected to longitudinal mixing by which particles of water containing organic matter in different states of biochemical change and organisms in different states of development can interact. Longitudinal mixing was simulated under laboratory conditions interact. Longitudinal mixing was simulated under laboratory conditions by mixing samples with different ages of incubation. The results proved the assumption. The study also included a hydraulic explanation of longitudinal mixing which was characterized by the dimensionless number, (increment of dispersion)/ (increment of mean detention period). The behavior of this parameter as ascertained in laboratory flume tests is very similar to the BOD decomposition rate changes as stated above. (Novotny-Vanderbilt)
W70-01381

WIND INFLUENCE UPON COOLING WATER CIRCULATION,
Waterloopkundig Laboratorium, Delft (Netherlands).
G. Abraham, and R. Koudstaal.
Journal of Power Division, ASCE, Vol 95, No PO1, p 63-75, Mar 1969. 6 fig, 4 tab.

Descriptors: *Electric power production, *Water cooling, *Winds, Flow, Temperature.

A field investigation performed in a cooling water circuit formed by a wide canal of an existing power plant shows the important influence of wind upon cooling water circulation. With the aid of measured float tracts a coefficient n could be estimated indicating which part of the cooling water, leaving the outlet channel is flowing directly to the inlet channels. The coefficient n can be found by the relationship (T sub in) - (T sub o)= (n/ (1 - n)) (T sub A - T sub in) where T sub in is the temperature of the cooling water in the plant directly behind the inlet, T sub o is the background temperature, T sub A is the temperature at some point A which can be found by (T sub A)= 1 - (Q sub ex/Q sub c) (T sub in+ delta T)+ (Q sub ex/Q sub c) T sub o where Q sub ex is the quantity of water exchanged through the interface, delta T is the rise in temperature of cooling water within the plant and Q sub c is quantity of cooling water discharged per unit time. Values of n of 0.4 to 0.7 have been found. For the power plant under consideration the relationship was compared with available records of the inlet

temperature. An adequate starting point was given to determine if the existing power plant can be enlarged without creating difficult conditions for the supply of cooling water. (Upadhyaya-Vanderbilt)
W70-01394

CHEMICAL POLLUTION OF THE SEA AND THE LAW (FRENCH),
Montpellier Univ. (France). Faculte de Droit.
J. P. Queneudec.
Revue Internationale d'Oceanographie Medicale, Vol XIII-XIV, p 217-230, 1969. 19 ref.

Descriptors: *Legal aspects, *Oil, *Water pollution, *Water pollution sources, Oceans, Ships.
Identifiers: Oil spills, Underwater oil deposits, Hydrocarbons.

Without being completely neglected, chemical substances which pollute the oceans have until the present been the occasion for the establishment of few laws, except in the case of the hydrocarbons. Pollution by hydrocarbons has been the object of detailed national and international rules covering pollution from both the cleaning of tanks on ships and the exploitation of underwater oil deposits. The author notes that the pollution from underwater oil wells is more easily dealt with by the law than oil waste from ships because of the traditional liberty of the high seas. (Tyner-Washington)
W70-01473

MINERALIZED SPRINGS AND THEIR EFFECT ON UTAH'S WATER SUPPLIES,
Utah Water Research Lab., Logan.
J. H. Milligan.
In: Groundwater Development in Arid Basins - Symposium, Utah State University, 1967, Proceedings. Utah State University, Logan, p 43-50, 1967. 8 p, 2 fig, 11 ref.

Descriptors: *Impaired water quality, *Streams, *Groundwater, *Water quality control, *Springs, Salinity, Great Basin, Irrigation, Utah, Water mangement, Mineral water.
Identifiers: *Marine sediments.

The study's objectives were to inventory Utah's highly mineralized springs, their quantities and qualities, and to determine their potential contaminating effect on regular water supply and possible means of control. A good water supply can be reduced just as effectively by lowering its quality as by reducing its quantity. Most of the mineralized springs lie in the Great Basin and are associated with major fault patterns. They bring dissolved salts to the surface from old marine sediments which antedate more recent uplifting and folding. Water from some of these springs merely spreads out over the desert, evaporates and leaves dry salt beds. Others flow into surface streams, thus lowering the quality. Fortunately, only a few of the springs sampled seriously impaired the quality of surface water supplies. However, it is conjectured that these may also be an unknown effect on groundwater supplies. The effect on surface waters is likely to increase as more water is diverted for use above the springs. The construction of dams to control the flow of important surface waters could help control the rate of contamination during the irrigation season. (Crouse-Arizona)
W70-01486

CRAZED RESIN FILTRATION OF COMBINED SEWER OVERFLOWS.
Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.

Water Pollution Control Research Series, DAST-4, Oct 1968. 78 p, 19 tab, 26 fig, 14 ref, 2 append. FWPCA Program 11020, Contract No 14-12-39. Available from the Clearinghouse as PB 187 867, $3.00 in paper copy, $0.65 in microfiche.

Descriptors: Pollution control, Pre-treatment (Water), *Filters, *Filtration, Separation techniques.
Identifiers: *Resin, *Crazing, Volume Reduction, Pollutant Concentration.

The feasibility of developing a self-cleaning, self-adjusting filtering device constructed of cylindrical structures of fibers laid down in predetermined patterns by a winding process and bonded in place by resins was investigated. The permeability of the structure is imparted by a mechanical cracking of crazing of the resin. Filtration runs showed a 62 percent reduction of suspended solids in the filtrate. However, sustained runs could not be realized. The self-cleaning aspect was not demonstrated.
W70-01487

REDUCTION OF GROUNDWATER INFILTRATION INTO SEWERS BY ZONE PUMPING AT MERIDIAN, IDAHO.
Hoffmann and Fiske, Boise, Idaho.

Water Pollution Control Research Series DAST-9, 1969. 28 p, 13 fig. Available from the Clearinghouse as PB 187 868, $3.00 in paper copy, $0.65 in microfiche. FWPCA Program 11020, Grant 29-IDA-2.

Descriptors: *Infiltration.
Identifiers: Volume reduction, Surcharging, *Zone-pumping, *Groundwater infiltration.

The reduction was investigated of goundwater infiltration into sanitary sewers by pump down of the water table in the sewer area assuming the geology, precipitation and local irrigation practices were ameanable to rapid and wide zones of influence. The water table was lowered below the sewer and reduced the volume of flow to the treatment plant. The water table was not lowered uniformly. For 140 square blocks 70 pump units would be required at an average cost of $40,000 per unit with a total power bill of $122.50 per day. This is not economically favorable when compared with other corrective measures.
W70-01489

CONSERVANCY.
For primary bibliographic entry see Field 04A.
W70-01585

CONSERVANCY.
For primary bibliographic entry see Field 04A.
W70-01586

CONSERVANCY.
For primary bibliographic entry see Field 04A.
W70-01587

CONSERVANCY.
For primary bibliographic entry see Field 04A.
W70-01588

WATER POLLUTION CONTROL.

Ky Rev Stat Ann secs 220.580-220.990 (1963).

Descriptors: *Kentucky, *Water pollution control, *Water conservation, *Water pollution, Waste disposal, Legislation, Legal aspects, Rivers, Streams, Administrative agencies, Sewage, Industrial wastes, Wastes, Water supply, Treatment facilities, Administration, Federal government, Investigations, Specifications, Permits, Regulation, Pollution abatement.
Identifiers: *Water quality standards, Penalties (Criminal).

Included among the terms defined relative to water pollution control are water, pollution, sewage, industrial wastes, other wastes, sewer system, treatment works, and disposal system. It is the declared policy of the state to conserve the state's waters for specified purposes, to provide an effective program of pollution control and to provide for cooperation with state and federal agencies in carrying out the foregoing objectives. The Water Pollution Control Commission is created to carry out the provisions of this act, and its administration is provided for. Included among the specified powers and duties of the Commission are those of: (1) supervising the administration of this act; (2) developing a pollution control program; (3) implementing the program once it is developed; (4) setting water quality standards; (5) adopting regulations necessary to accomplishing the purposes of this act; (6) issuing permits for waste discharge; and (7) enforcing the provisions of this act and regulations adopted hereunder. The Commission is further authorized to perform certain acts to secure to the state the benefits of the Federal Water Pollution Control Act. It is made unlawful for any person to discharge waste into state waters in contravention of the Commission's water quality standards or to do so without a Commission permit. (Keith-Florida)
W70-01589

WATER POLLUTION CONTROL.

Ky Rev Stat Ann secs 220.580-220.600 (1963)

Descriptors: *Kentucky, *Water pollution control, *Water conservation, *Water pollution, Waste disposal, Legislation, Legal aspects, Administrative agencies, Rivers, Streams, Lakes, Ponds, Reservoirs, Springs, Water wells, Marshes, Surface waters, Subsurface waters, Sewage, Water supply, Water conservation, Wildlife, Recreation, Pollution abatement, Administration, Federal government.
Identifiers: *Pollution prevention.

For the purposes of this act the following terms are defined in the following manner: 'water' means all rivers, streams, creeks, lakes, ponds, reservoirs, springs, wells, marshes, and other bodies of surface or underground water, natural or artificial; 'pollution' means the discharge of waste in such condition or quantity as may contaminate state waters to the detriment of any legitimate use; 'sewage' means water-carried human or animal wastes and industrial wastes; and 'disposal system' means a system of waste disposal. It is the declared policy of the state to: (1) conserve state waters for public water supplies, wildlife propagation, and for agricultural, industrial, recreational, and other legitimate uses; (2) provide a program for the prevention, abatement, and control of pollution; (3) provide effective means for the execution and enforcement of such a program; and (4) provide for cooperation among state and federal agencies in carrying out these objectives. It is the purpose of this act to safeguard from pollution the uncontaminated waters of the state, to prevent further pollution, and to abate existing pollution. The Water Pollution Control Commission is created for the purpose of carrying out the provisions of this act; its administration is expressly provided for. (Keith-Florida)
W70-01590

WATER POLLUTION CONTROL.

Ky Rev Stat Ann secs 220.610-220.990 (1963).

Descriptors: *Kentucky, *Water pollution control, *Waste disposal, *Water pollution, Legislation, Legal aspects, Administrative agencies, Treatment facilities, Water conservation, Pollution abatement, Administration, Federal government, Investigations, Research and development, Construction, Specifications, Permits, Jurisdiction, Regulation, Financing, Supervisory control (Power).
Identifiers: *Water quality standards, *Pollution prevention, Penalties (Criminal).

The Water Pollution Control Commission is empowered to: (1) supervise the administration and enforcement of this act and regulations promulgated hereunder; (2) develop a program for the prevention, control, and abatement of water pollution; (3) encourage and conduct studies, investigations, research, and demonstrations to enable it to

lisseminate information relating to water pollution; (4) establish water quality standards for waters according to their particular uses; (5) adopt regulations for the prevention, abatement, and control of pollution as it deems necessary for the accomplishment of the purposes of this act; (6) issue permits for the discharge of wastes and for the operation of disposal systems and treatment works; (7) pass on all plans and specifications for the construction of proposed systems and works; and (8) take such action as is necessary to secure to the state the benefits of the Federal Water Pollution Control Act including cooperation, fund acquisition, project approval, and participation in federal programs. It is unlawful for any person to discharge wastes without a permit or to construct a disposal system without a permit. The Commission holds public hearings before adopting regulations of general applicability; the manner in which such hearings will be conducted is set out. (Keith-Florida)
W70-01591

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
For primary bibliographic entry see Field 06D.
W70-01593

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
For primary bibliographic entry see Field 06D.
W70-01594

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
For primary bibliographic entry see Field 06D.
W70-01595

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
For primary bibliographic entry see Field 06D.
W70-01596

INCORPORATION OF SANITATION DISTRICTS.
Va Code Ann secs 21-154, 21-168, 21-175 (1960).

Descriptors: *Virginia, *Tidal waters, *Water pollution control, Public health, Water pollution effects, Pollutants, Disposal, Environmental sanitation, Impaired water quality, Treatment facilities, Legal aspects, Legislation, Surveys, Investigations, Supervisory control (Power), Water pollution treatment, Pollution abatement.

Each sanitation district heretofore or hereafter created in the state is incorporated by this act and shall be known as a commission. Each commission has all the powers of a private corporation. In addition, each commission has as its primary purposes the protection of state tidewaters from pollution and the improvement of conditions affecting the public health and natural oyster beds, rocks, and shoals. Each commission may enter on any lands or waters for the purpose of making surveys, borings, soundings, or other examinations and may make and enforce rules or regulations for conducting its affairs. The State Health Commissioner must approve any method used by the commission for treating and disposing of sewage and industrial wastes so as to prevent the pollution of the tidal waters of the district. (Kelly-Florida)
W70-01608

PUBLIC UTILITIES AND POLLUTION PREVENTION.
Va Code Ann secs 15.1-292, 15.1-301, 15.1-307, 15.1-318, 15.1-320, 15.1-333 (1964), as amended, (Supp 1968).

Descriptors: *Virginia, *Public utilities, *Water pollution control, *Leases, Cities, Local governments, Governments, Water supply, Water works, Utilities, Electric power, Condemnation, Right-of-way, Ducts, Electrical power production, Powerplants, Disposal, Contracts, Sewage disposal, Ventilation, Pumping plants, Treatment facilities, Sewers, Pollution abatement, Water pollution, Water pollution sources, Costs, Sanitary engineering.

The governing body of every county, city, and town may acquire or establish water works, gas works, electric plants, sewage disposal systems, and other public utilities and may acquire the land and rights of way necessary for such purpose. Such governing body may also prevent water pollution by construction of drains, sewers, and public ducts. Absent public sewers, any landowner may establish and maintain a sewer from his land, along any public way, to the nearest natural watercourse. No rights of any city or town to its water front property, gas, water, and electric works shall be sold except by special ordinance. No lease of such public property shall be granted for more than thirty years. Any such lease may provide that upon termination the plant as well as the property shall become the property of the city or town. Any two or more counties, cities, or towns may enter agreements concerning sewers, pumping stations, ventilation stations, treatment plants, or any other such works. (Smith-Florida)
W70-01622

WATER POLLUTION CONTROL BY MUNICIPALITIES.
Va Code Ann secs 15.1-854 thru 15.1-856, 15.1-858, 15.1-867 (1964).

Descriptors: *Virginia, *Water pollution control, *Regulation, *Local governments, Cities, Governments, Inspection, Water supply, Water distribution (Applied), Water transfer, Sewers, Sanitary engineering, Culverts, Drains, Sewerage, Septic tanks, Swimming pools, Lakes, Pollution abatement, Water pollution, Sources, Diseases, Weeds, Snow, Stagnant water, Costs, Municipal water, Legislation, Supervisory control (Power).

A municipal corporation may regulate and inspect the following, whether public or private: water supplies; the production, preparation, transmission and distribution of water; the sanitation of systems, facilities and equipment which produce, prepare, transmit or distribute water; sewers; culverts; drains; sewerage; disposal and treatment systems; septic tanks; swimming pools; lakes; and other natural or artificial waters operated by clubs and associations. Such municipal corporation may adopt regulations deemed necessary to prevent the pollution of public or private waters, to prevent the transmission or distribution of impure water, to require the use of septic tanks where sewers are not available, to prevent the operation of sewers and drains which may cause pollution or the spread of disease, and to prevent the use of swimming pools or lakes when such waters are found to be polluted or dangerous. A municipal corporation may compel the abatement or removal of all nuisances from private or public property including weeds, snow, unsanitary or unhealthy substances allowed to accumulate, stagnant water and unsanitary structures. If the owner fails to so remove any nuisance, the municipal corporation may do so at the owner's expense. (Smith-Florida)
W70-01624

FEDERAL ROLE IN POLLUTION CONTROL,
James L. Agee.
Amer Water Works Assoc J, vol 61, no 10, p 499-503, Oct 1969, 5 p.

Descriptors: *Water pollution control, *Water quality, *Waste disposal, *Waste treatment, Legal aspects, Federal government, Administrative agencies, Water supply, Potable water, Public health, Sewage treatment, Construction, Reservoirs, Water Quality Act, Legislation, Financing, River basins, Investigations, Industrial wastes, Thermal pollution, Permits, Watersheds (Basins), Water pollution effects, Standards, Water utilization, Interstate rivers.

The pollution control concept has broadened from protection against public health hazards alone to an awareness that water is polluted and that action is needed whenever any of man's desired water uses are inhibited by its quality. This expansion began with the Federal Water Pollution Control Act of 1956, which provided for research and training. It continued with passage of the 1965 Water Quality Act which required the establishment of water quality standards on all interstate waters. This expansion culminated in the Clean Waters Restoration Act of 1966, which provided financing to achieve the goal of clean water. The agency organizational changes which have accompanied this expanding concept are noted. The purpose of the federal effort is to enhance the quality and value of our nation's water resources through the prevention, control, and abatement of water pollution. Examples are given of how this purpose is manifested in federal policy: quality standards should be designed to enhance the quality of water; all waste discharged should receive best practicable treatment; and water whose quality exceeds the standards should not be degraded arbitrarily. Current issues in and proposed legislation regarding pollution control are discussed; several new technical developments in the field are divulged. (Keith-Florida)
W70-01625

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

ATLANTIC STATES MARINE FISHERIES COMPACT.
For primary bibliographic entry see Field 06E.
W70-01318

ECONOMIC ANALYSIS IN THE ALLOCATION OF THE FEDERAL BUDGET TO RESOURCE DEVELOPMENT,
Arizona Univ., Tucson.
M. M. Kelso.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 56-81, 1964. 26 p, 28 ref.

Descriptors: *Water resource development, *Benefits, *Costs, *Budgeting, *Welfare economics, *GNP, *Cost allocation, Economic evaluation, Economic analysis, Taxes, Economic efficiency, Government supports, Watershed, Prices, Input-output analysis, Risks, Irrigation.
Identifiers: *Decision making, Maximized dollar value, Net gains, Flood Control Act.

This article examines the present stage in the developments of defining and organizing the concepts and measurements needed in water resource development at the Federal level. Covered under this category are almost all federal water and watershed development proposals by combinations of congressional and agency practice. It is proposed that in economic evaluation among alternative projects, a welfare maximum is unattainable. Such alternatives may be ordered by way of the criterion 'enhancement of national income,' which is, in turn, an outcome of enhancement of economic efficiency. An appropriate model to serve the needs of the criteria of benefits and costs must include the present worth of net gains, the restraints on federal funds, the opportunity costs of federal funds, and some value for 'pure benefits'. In addition, the model will include such elements as measurement, market prices, imputed values, uncertainty, the rate of discount, and net prime benefits values. Financial and budgetary restraints are included from the viewpoint of opportunity costs in their

relation to federal resource policy. (Murphy-Rutgers)
W70-01346

STATE AND LOCAL GOVERNMENTS AND THEIR BUDGET CONSTRAINT,
Board of Governors of the Federal Reserve System, Washington, D.C.
For primary bibliographic entry see Field 06C.
W70-01353

FISCAL POLICY AND EFFECTS OF GOVERNMENT PURCHASES: AN INPUT-OUTPUT ANALYSIS,
Wayne State Univ., Detroit, Mich.
Karl W. Roskamp.
Public Finance, Vol 24, No 1, p 33-47, 1969. 15 p, 4 tab.

Descriptors: *Input-output analysis, Expenditures, Leontief models, Taxes.
Identifiers: *Fiscal policy, *Government purchases, Walrasian general equilibrium, Short run policy, West Germany, Budget balance, Factor incomes, Income effects.

In this paper an effort is made to trace the effects of changes in the composition of government expenditures given the structure of production of an economy. The author's particular interest is in the effects of changes in government purchases of goods and services. Ideally this topic should be studied at the micro level. It would be desirable to investigate the effects of government purchases on individual firms and households. The Walrasian general equilibrium system would be the suitable framework for such a study. However, such a system is not operational and due to its size and complexity it cannot be handled with the available computing facilities. The author makes use of a more aggregate but operational model, the Leontief input-output model. The Leontief input-output model reflects the inter-industry relationships of an economy. If the model is sufficiently large it can provide detailed information on direct and indirect effects of fiscal measures which should be useful for short run policy purposes. This type of model who adopted to investigate the effects of changes in government purchases. Such types of models have long been used in the water area. Recently, they have been incorporated in studies dealing with water in the Western states and the economic effects of changes in 'the water sector' via government investment decisions can be traced. (Loeb-Rutgers)
W70-01356

AN EMPIRICAL TEST FOR DECISION RULE,
Michigan State Univ., East Lansing.
Frances M. Magrabi.
Journal of Consumer Affairs, Vol 3, No 1, p 41-51, Summer 1969. 11p, 2 tab, 6 ref.

Descriptors: *Decision making, *Planning, Project planning, Economic justification.
Identifiers: *Decision rule, Decision model, Lexicographic ordering, Choice.

This paper describes a study undertaken for the purpose of identifying decision rules which are consistent with actual choice. A model of a partial decision system was formulated which included a specification of the elements of the system and the source of their properties. However, it left unspecified those which could convert it into a closed system, that is, one in which choice of an element is a logical consequence. Choice was then made to depend on a decision rule, for which omitted relationships could be inferred. On the basis of some assumptions concerning relevant dimensions and their appropriate scales for measurement, a test was constructed in which some inferences concerning the decision rule could be made from the choices of respondents. In the first section the decision model is stated; in the second section the instrument used in collecting data is described. Section three summarizes conclusions and points out some implications of the results with respect to the model. Such models might be applied to the water area to aid in planning and investment decisions in the context of selecting projects on the basis of benefit-cost criteria. (Loeb-Rutgers)
W70-01368

RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY,
Department of Health, Education, and Welfare, Philadelphia, Pa.
For primary bibliographic entry see Field 05G.
W70-01380

6B. Evaluation Process

STATISTICAL EVALUATIONS OF A CLOUD-SEEDING PROGRAM AT THE STREAMFLOW CONTROL LEVEL,
Washington State Univ., Pullman. Coll. of Economics and Business; and Washington Water Research Center, Pullman.
For primary bibliographic entry see Field 03B.
W70-01247

ATLANTIC STATES MARINE FISHERIES COMPACT.
For primary bibliographic entry see Field 06E.
W70-01336

CHOICE OF ADJUSTMENT TO FLOODS,
Chicago Univ., Ill.
Gilbert F. White.
Chicago, University of Chicago, 1964. 150 p.

Descriptors: *Flood plains, *Management, *Planning, Technical feasibility, Economic efficiency, Timing, Flood damage, Interest rates, Costs, Benefits, Capital, Flood proofing, Insurance, Cost-benefit analysis, Cost sharing, Land use, Flood protection.
Identifiers: *Flood adjustments, *La Follette (Tenn), Social benefits, Stage-demand curves.

This is an examination of conditions in which managers of flood plain property chose among eight possible adjustments to floods. Factors affecting the path which adjustment takes are analyzed along with the technical feasibility of each. A detailed analysis is given to evaluating the economic efficiency of each adjustment process for different interest rates and flood frequency assumptions. Net benefits, residual losses plus costs, cost-benefit ratios and operating capital ratios are computed for the various adjustments. The differences between public and private adjustments and the importance of timing are also evaluated. It was found that there were few regularities in the choices preferred by private managers. The character of the decision made by the private manager is guided by three different factors and methods are suggested in which the community can affect these factors in order to reduce flood losses. (Loeb-Rutgers)
W70-01341

ECONOMIC EVALUATION OF LAND DRAINAGE WORKS,
Trent River Authority (Gt. Brit.).
M. Nixon.
River Engineering and Water Conservation Works, edited by R B Thorn, London, Butterworth and Co, Ltd., p 47-51, 1966. 5 p, 6 ref.

Descriptors: *Land-drainage works, *Economic evaluation, *Cost-benefit analysis, Costs, Decision-making, Maintenance costs, Capital, Indirect benefits, Intangible benefits, Flood damage, Economic life, Monetary value, Flood protection, Conservation.
Identifiers: *National interests.

The five objectives of land drainage works are given followed by an explanation of the direct and indirect benefits associated with such a project. The concept of the cost/benefit ratio in economic evaluation is explained. This necessitates a monetary assessment of the accruing benefits which calls for an understanding of the concept of economic life. The most economically sound way of assessing the benefits from land drainage works is presented for direct, indirect, and intangible benefits. Care should also be taken to include maintenance costs and the deficiencies of economic evaluations. Related to this last point, arguments against the use of cost-benefit analysis are presented. (Murphy-Rutgers)
W70-01342

ENGINEERING AND ECONOMICS IN PROJECT PLANNING,
Stanford Univ., Calif.
Ray K. Linsley.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 93-103, 1964. 11 p, 4 fig, 6 ref.

Descriptors: *Engineering, *Economics, *Project planning, *Irrigation, *Frequency analysis, *Risks, *Statistics, Safety, Economic efficiency, Costs, Benefits, River basins, Flood control, Time, Random process, Dams spillways, Watersheds, Water quality.
Identifiers: *Climatic trend, Power projects.

This article views engineering and economics as the essential features of project planning. Effective engineering will result in satisfying the requirements of safety, efficiency, economy, and esthetics. Engineering design techniques and economic principles are discussed as applied to water-project planning. In this planning there are substantial differences in costs and benefits among equally acceptable designs. Equal uncertainties exist in the evaluation of the economic consequences of these projects. A systematic approach is called for in analyzing the various principles of design in water projects to assure that all possible alternatives are considered. Basic data must be collected on all aspects of water planning and better use must be made of this data. Research programs and education programs in new methodology are urgently needed to fulfill these goals. All project evaluation should include analysis of the probable effect of unavoidable uncertainties on the relation of benefit to cost to insure that the final decision on feasibility is made with complete knowledge of the probability that the decision could be wrong. (Murphy-Rutgers)
W70-01344

RATIONAL CHOICES IN WATER RESOURCES PLANNING,
Stanford Univ., Calif.
Hubert Marshall.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 403-423, 1964. 21 p, 38 ref.

Descriptors: *Planning, *Decision making, *Economic analysis, *Risks, *Interest rate, *Economic efficiency, *Water resources development, Investment, Income, Cost-benefit analysis, Dams, Floods, River basins, Erosion, Navigation, Taxes, Optimization, Value.
Identifiers: *Rational choice, *Balance of interest, Power output.

This article deals with the model of rational choice in decision-making in water resources planning. The ideal of such a model calls for value identification, value-ranking, identification of alternatives, consequences of all alternatives, and evaluation of the consequences in terms of the identified values. The theory behind this model is that knowledge contributes to the likelihood of viable decision. Economic analysis contributes heavily to this decision-making process in the high ranking of

economic consequences. Economic information lessens the area of uncertainty. Such information can also cast light on conflicts over competing and mutually exclusive uses and on the economic motives of interest groups that play an important part in decision-making. Economic analysis can also indicate the economic consequences of letting non-market criteria dominate the decision-making process, and thus contribute to the rationality of this process by furthering the adequacy of the decision-maker's knowledge in water resources planning. (Murphy-Rutgers)
W70-01347

PROMISES AND HAZARDS OF MAN'S ADAPTABILITY,
Rockefeller Univ., New York.
Rene Dubos.
Environmental Quality in a Growing Economy, edited by H Jarrett, Baltimore, The Johns Hopkins Press, p 23-40, 1966. 17 p.

Descriptors: *Environment, *Genetics, *Diversification, Human diseases, Pollutants, Economics, Smog, Water pollution, Population, Public health, Technology, Cities, Efficiencies.
Identifiers: *Socio-cultural processes, *Adaptability, *Human traits, Mutation, Malnutrition medicated survival, Prosperity, Biological past, Frontiers.

This article deals with man's ability to live under 'unnatural' conditions, or environmental changes. Animals adapt to these changes through genetic change, whereas man's genetic structure remains basically unchanged. Technological civilization can survive only if it takes cognizance of these fundamental biological attributes of mankind which are essentially unchangeable. The goal of technology, however, should not be to provide man with a sheltered environment in which he is protected from trauma, for certain traits in man's nature cannot develop normally or remain healthy without constant stimulation and challenge. The monotony of technological culture can eliminate human traits, at least in their phenotypic expression. To avoid this, a deliberate effort should be made to create and maintain as diversified an environment as possible, even at the expense of efficiency. This diversity should be a crucial test of true functionalism, since it is needed to bring out the unexpressed potentiality of mankind. Since water resources are an important aspect of environmental studies, and provide the basis for a diversified environment within the urbanizing society, this article can be of interest to water resource researchers. (Murphy-Rutgers)
W70-01350

THE ECONOMIST AND THE ENGINEER: ECONOMIC DYNAMICS OF WATER RESOURCE DEVELOPMENT,
Michigan Univ., Ann Arbor.
Kenneth Boulding.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa, Iowa State University Press, p 82-92, 1965. 11 p.

Descriptors: *Water resource development, *Engineering, Dams, Prices, Irrigation, Public utilities, Flood control, Flood plain, Government supports, Fixed costs, Resource allocation, Technology, Taxes, Income.
Identifiers: *Urban water supply, Bureau of Reclamation, Income distribution.

At present water resources are usually developed by engineers. However, there is much that the economist can contribute. The engineer is project oriented whereas the economist is system-oriented. The engineer is concerned with the physical construction of a project whereas the economist is concerned with the value attached to it relative to everything else. The biggest difference between the two is that the engineer considers the price system as given whereas the economists think of it as a variable open to change. With regard to public versus private development of water resources the author makes an argument for more private enterprise in this area. He then discusses the relative states of development in the water resource area. In line with this, the price structure performs the functions of allocating resources, distributing income, and directing technical change and should be used to regulate all three. These are some of the aspects of water resource development which the economist should make the engineer cognizant of. (Murphy-Rutgers)
W70-01352

REGIONAL DEVELOPMENT AND THE WABASH BASIN,
Illinois Univ., Urbana.
R. R. Boyce.
Urbana, Illinois University of Illinois Press, 1964. 218 p.

Descriptors: *Water resources development, *River basin development, *Recreation, Regional analysis industries, Political aspects, Water management, Transportation, Population employment, Agriculture, Technology, Wages, Flood damage, Reservoirs, Growth rates, Investment, Optimization.
Identifiers: *Wabash Basin, *Regional planning, Economic development, Differential growth, Industrial development, Delaware River Basin.

This book is a collection of essays by different authors. It is an attempt to explore some of the more fundamental questions of regional development within the realities of a specific area, the Wabash Basin. The book is organized into four main parts. Part one lays the foundation for the general discussion on regional development and change by providing specific information on the Wabash basin. Part two discusses the problems and prospects of regional development and change. First, a general national framework of regional change is presented and then the problems of effecting plans and determining policy are discussed. Part three is concerned with water and economic development. Both the nature of water resources as an initiator of regional change and the political and administrative framework required for such development are discussed. The final part of the book presents a possible model for optimum regional economic development. (Murphy-Rutgers)
W70-01354

FISCAL POLICY AND EFFECTS OF GOVERNMENT PURCHASES: AN INPUT-OUTPUT ANALYSIS,
Wayne State Univ., Detroit, Mich.
For primary bibliographic entry see Field 06A.
W70-01356

UNIFICATION OF ENGINEERING ECONOMY: THE NEED AND A SUGGESTED APPROACH,
Case Western Reserve Univ., Cleveland, Ohio.
Arnold Reisman.
The Engineering Economist, Vol 14, No 1, p 1-24, Fall 1968. 24 p, 7 fig, 2 tab, 19 ref.

Descriptors: *Economics, *Investment, Time, Management, Sinking fund, Price, Salvage value, Payment, Interest, Costs, Income.
Identifiers: *General models, *Engineering economy, Economic analysis, Unification, Present worth, Annuity, Deferred annuity, Capital recovery, Time interval.

It is well recognized that human learning proceeds from the familiar to the less familiar and to the unknown, and from the particular to the general. In the theory of economic analysis, however, there is, at any given stage of development, much to be gained from an ability to proceed from the general to the particular. In the field of chemistry, Mendeleyev's periodic table removed many burdens from the students of chemistry and in a very straightforward fashion pointed the way to discovery of new elements. Mendeleyev developed this chart by reflecting on the work of others and achieving a synthesis that demonstrated a pattern and gave meaning to formerly unconnected elements. The author contends that the various fields of management science in general and the field of economic analysis in particular are now ripe for this kind of generalization. The author briefly describes a general model for investment analysis in the hope that this will convince researchers of the need of a synthesis in the fields of managerial and engineering economy. Accordingly, one may infer that such general models will be of aid in the water area in synthesizing complex investment and capital budgeting problems. (Loeb-Rutgers)
W70-01357

THE EFFECT OF PROJECT LIFE DISPERSION ON KEY INTEREST FACTORS FOR ECONOMIC ANALYSES OF CAPITAL INVESTMENT,
North Carolina State Univ., Raleigh.
John R. Canada, and Harrison M. Wadsworth.
The Engineering Economist, Vol 11, No 4, p 15-36, Summer 1966. 22 p, 12 fig, 7 ref, 1 append.

Descriptors: *Economics, *Investment, *Capital, Variability, Risks, Interest rate, Distribution patterns, Project life.
Identifiers: *Project life dispersion, Project worth, Expected value, Capital recovery factor, Present value factor, Normal distribution, Uniform distribution, Beta distribution.

There is little question that project life is an important element in determining the prospective worth or relative desirability of an investment project. The dispersion or variability which can occur in project life is a prime candidate for consideration whenever the effect of risk is taken into account in an economic analysis of a prospective project. This condition is due to the typically high degree of sensitivity of project worth, or relative desirability, to changes in project life. The purpose of this paper is to discuss the effect of the dispersion of the life of a project on expected values of two key factors in economic analyses. This analysis enables one to observe the relative effects of different life distribution shapes, distribution variances, and interest rates. At the same time, it is hoped that the graphical analysis presented will permit a better judgment of when it is worthwhile to explicitly consider the effect of high dispersion by calculating the expected value of one or both of these key factors. This analysis might aid the water researcher attempting to decide on the desirability of an investment project. (Loeb-Rutgers)
W70-01359

AN ECONOMIC THEORY OF TECHNOLOGICAL CHANGE,
Yale Univ., New Haven, Conn.
W. D. Nordhaus.
American Economic Review Vol LIX, No 2, p 18-28, May 1969. 11 p, 3 tab, 12 ref.

Descriptors: *Productivity, *Technology, *Interest rate, Capital, Labor, Monopoly, Consumption, Pricing, Costs, Equilibrium, Patients.
Identifiers: *Technological change, Maximum likelihood estimator, Entrepreneurs invention, Factors of production.

The article is an attempt to establish a reasonable model of the inventive process for the purpose of sorting out the sources of productivity change among the different factors of production. Technological change has largely been neglected in economic analysis. The author derives his model and incorporates it into the conventional neoclassical model of the economic system. The chief differences in the structures are found to be that technology can be interpreted in the growth equation as a capital good with unitary exponent and that the technology-formation function derived is quite different from the capital formation equation. The conclusions of the model are tested and it is found that patents are positively correlated with in-

creases in output but negatively correlated with the level of productivity. The hypothesis of a relation between the flow of patented inventions and the growth of productivity is not supported by the testing and subsequent explanations for this result are suggested. The obvious ramifications of changes in the production function to the water resource area make this article pertinent to the water resource planner. (Murphy-Rutgers)
W70-01360

EVALUATION OF GOVERNMENT INVESTMENT PROJECTS,
Illinois Univ., Urbana, Ill.; and Temple Univ., Philadelphia, Pa.
John Due, and W. Lynn Holmes.
Public Finance Vol XXII, No 3, p 255-263, Spring 1967, 9p.

Descriptors: *Investment, *Government, *Economic analysis, Interest rate, Capital, Mathematical studies, Value, Indirect benefits, Profits, Risks, Economic evaluation, Economic justification.
Identifiers: *Discounting-forward, *Earnings, *Rate of return, *Cumulative adjustment, Depreciation.

This article is concerned with the question of net returns from investment projects as a basis for investment decision-making by government. An evaluation of existing projects to determine if they were economically justifiable has the advantages of focusing attention on neglected problems and suggesting new approaches. The analysis performed is directly applicable to government investment projects whose indirect benefits may be estimated in monetary terms. This would include many investment projects in the water resources area. The elements to be used in evaluation are mentioned along with the problems common to different evaluation approaches. The four major methods of evaluation are considered, that is, the ascertainment of initial year value, the forward cumulation of earnings and investment to the terminal year, the use of cumulated forward-moving year-to-year adjustment and the calculation of the internal rate of return. The success of each in an empirical study is summarized. (Murphy-Rutgers)
W70-01365

PRICING PIONEERING PRODUCTS,
Joel Dean Associates, Inc., Hastings-On-Hudson, N.Y.
Joel Dean.
Journal of Industrial Economics, Vol 7, No 3, p 165-179, July 1969. 15p.

Descriptors: *Pricing, Demand, Costs, Competition, Prices, Investment, Monopoly.
Identifiers: *Pioneer products, Innovation, Monopoly pricing, Price range, Sales, Rate-of-return pricing, Skimming pricing, Penetration pricing promotion.

A pioneer product is defined here as one which incorporates a major innovation. Its market is therefore, at the outset, ill-defined, since potential applications cannot be foreseen with precision. Pricing decisions usually have to be made recognizing wide margins of error in the forecasts of demand, cost, and competitors' capabilities. The difficulty of pricing new products is enhanced by the dynamic deterioration of the competitive status of most new products, where market decay is speeded by the high rate of innovation. This condition makes the life cycle of a new product's economic status a strategic consideration in practical pricing. This paper is concerned with the level of price of the new product and not its price structure (i.e. the average price per pound of a good and not the structure of price differentials depending on quality-spreads, order-size, distribution-channel, geographical location, etc.). The author concludes with nine pricing precepts for new product lines. This paper may have relevance for pricing the water service products of water systems based on changing technology (without adapting profit maximizing goals as the criterion for the pricing schedule). (Loeb-Rutgers)
W70-01367

WELFARE METHODOLOGY AND THE MULTI-BRANCH BUDGET,
Dalhousie Univ., Halifax (Nova Scotia).
John G. Head.
Public Finance, Vol XXIII, No 4, p 405-424, 1968.

Descriptors: *Welfare economics, *Finance, *Ethics, *Political aspects, Income, Resource allocation, Employment, Taxes, Economic analysis, Budgeting, Optimization.
Identifiers: *Public finance, *Stability, Economic growth, Multi-purpose budget.

The author wishes to present a reexamination of the public finance framework. The article begins with a general discussion of the basic purposes which a welfare framework might be expected to serve. Included here is the study of a framework encompassing ethically-desirable policy proposals, a generally acceptable ordering of all economic situations, useful information for policy, and politically operational policy proposals. The author then attempts to clarify some apparent obscurities and inconsistencies in the standard formulation of the multi-branch budget. He shows that the problem of formulating and interpreting a framework of welfare objectives can be approached in any of the above manners and there is no reason that the primary emphasis should not be placed on one rather than another. Also, the main purpose to be served by the multi-branch budget of public finance theory needs to be interrupted in view of the purpose it is meant to serve. The importance of welfare economics in water resource development makes this article of interest to the water researcher. (Murphy-Rutgers)
W70-01369

REPLY ON COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL',
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 05G.
W70-01373

ON THE ACCURACY OF ECONOMIC OBSERVATIONS,
Oskar Morgenstern.
Princeton, New Jersey, Princeton University Press, 1963. 322 p.

Descriptors: *National income, *Income, *Growth rates, *Economics, *Measurement, *Statistics, Statistical methods, Time, Stability, Decision making, Foreign trade, Prices, Statistical models, Mathematical models, Mathematical studies.
Identifiers: *Accuracy, *Economic observations, *Certainty, *Error, *Economic statistics, Data, Designed experiments, Information, Observers, Questionnaires.

This study is the preliminary result of a prolonged concern with the properties of economic data. The book addresses itself to both the general reader and the professional economist. The author states that the former will see that decisions made in business and in public service are based on data that are known with much less certainty than generally assumed by the public or the government. The second group will discover that even the most widely accepted figures frequently have error components of unexpected magnitude and consequently cast doubt on many currently accepted analyses of economics. The situation pertaining to the concern with the accuracy of measurement in the social sciences, as compared to the natural sciences, may not be simpler, but even if it should be, there exists no comparable tradition of exploring errors and evaluating their influence upon economic science and its application. However, when the true conditions are realized, more powerful and realistic theory can be evolved. The author contends that we must distinguish between what we think we know and what we really do and can know. The observations and general topic of this book would be of interest to the economist involved in the water area where economic data provide the basis for empirical studies. (Loeb-Rutgers)
W70-01376

A NOTE ON LINEAR AGGREGATION OF ECONOMIC RELATIONS,
Delhi Univ. (India).
P. N. Misra.
International Economic Review, Vol 10, No 2, p 247-249, June 1969. 3 p, 1 ref.

Descriptors: Regression analysis, *Economics, Statistical methods.
Identifiers: *Linear aggregation, Economic relations, Macro coefficients, Micro coefficients, Matrix auxiliary regressions.

In this note the author shows that the relationships between the macro and micro coefficients derived by Theil can be derived in a simple way if one adopts a slightly different approach to the aggregation problem. The author considers the case of aggregation over a set of individuals. It is supposed that the micro relations, corresponding to a given set of individuals, are the true underlying relations indicating the micro behavior of the individuals. Further, the author defines the macro variables as the unweighted aggregates of observations on the micro variables over the set of individuals. The macro relations are then derived by applying a suitable transformation to the micro relation. In the second section of this note the layout of the micro and macro relations in matrix form are given. In section three, the author derives the relationships between the macro and micro coefficients. Issues of the aggregation problem are relevant to the specification and interpretation of water demand and use functions. Aggregation should be an important concern of empirical water analysis where an attempt is made to test economic theory with water and economic variables. (Loeb-Rutgers)
W70-01377

SEQUENTIAL PLANNING AND CONTINUAL PLANNING REVISION,
California Univ., Berkeley.
Steven M. Goldman.
Journal of Political Economy, Vol 77, No 4, Part 2, p 653-664, August 1969. 12p, 9 fig, 6 ref.

Descriptors: *Planning, Welfare.
Identifiers: *Sequential planning, *Continual planning revision. *Current preferences, *Social preferences, Periodic revision, Planned economy, Consumption.

This paper investigates the behavior of a planned economy within the context of neoclassical growth theory. The author is concerned with the difficulties faced by an economy where the wishes of the current population may diverge from those of the society as a whole. The author distinguishes between the desires of the current population-current preferences and those of all individuals in the society, regardless of when they will live. Since the current population constitutes the only group capable of expressing its preferences and since the composition of this group is continually changing, plans once formulated may become immediately obsolete. This potential inconsistency may be resolved through a procedure of continual planning revision or may be permitted to persist through some portion of the plan. This type of planning requires that at each moment in time the then current population be free to select whatever future plan it desires and to begin the immediate implementation of this program. Sequential planning implies the ability of the planner to determine the course of the economy over the entire planning period. The author also considers an intermediate form of planning in which programs may be scrapped and new ones instituted at points in time

before the expiration of the original plan. The author is concerned with the analyses of finite economic programs (such as those in the water area) in the context of the various types of planning techniques described above. (Loeb-Rutgers)
W70-01378

NATIONAL WATER RESOURCES ADMINISTRATION,
Yale Univ., New Haven, Conn.
James W. Fesler.
Economics and Public Policy in Water Resource Development. Edited by S. C. Smith, and E. N. Castle. Ames, Iowa State University Press, p 368-402, 1964. 35 p, 114 ref.

Descriptors: *Federal government, *Water resources, *Planning, *Water supply, *Utilities, *Watersheds, Treatment facilities, Droughts, Water supply, Flood control, Construction, Irrigation, Navigation, Fishing, Pollution, Dams, River system, Harbors, Recreation, Reclamation, Electric power, Forests.
Identifiers: *Economic development, Organization.

This article discusses the organization of the federal government for water resources responsibilities. National water resources administration is assumed to be the only feasible solution to economic problems for which the only alternative solutions are a valley authority or a joint regional instrument of the states and the federal government. Congressional stubbornness has resulted in conflicting water resource policies and in a complicated structure of committees for water resources. A drainage basin plan has helped ease these problems by focusing on area economic difficulties. Planning, construction and operation of water resources programs and projects should be consolidated in one department and should include other resource bases of economic development such as coal, oil and gas. The planning problem branch should concentrate on relating water to other economic resources and human needs. The entire department should recognize water resources development as an integral part of economic development, thus calling for broad-natured review and decisions. (Murphy-Rutgers)
W70-01379

THE LARGE PLANT CONCEPT,
Kellogg M. W. Co., New York.
For primary bibliographic entry see Field 06C.
W70-01555

PACIFIC SOUTHWEST WATER PLAN,
Department of the Interior, Washington, D.C.
W. I. Palmer.
Published by US Dept of the Interior, Washington, Aug 1963. 250 p, 26 tab, 9 fig.
Identifiers: *Proposals, *Southwest United States, *Water conveyance, *Water utilization, Brackish water, Canals, Economic evaluations, Feasibility study, Regional planning, Water sources, Water storage.

A comprehensive report covering a water and related resources development plan for the lower Colorado River Basin and adjacent area. The report blueprints actions to develop facilities needed to meet present requirements under reduced ground-water overdrafts, plus future requirements of the region until about 1990. Phase 1 of the plan would cost $1.9 billion and would include bridge canyon and marble canyon dams and powerplants on the main stream of the Colorado River, enlargement of the California state water project aqueduct, the central Arizona project, the southern Nevada water supply project, the dixie project in southwestern Utah, the Hooker Dam project in New Mexico, expansion of Indian irrigation project facilities, water salvage and ground-water recovery projects, initial programs related to fish and wildlife, and a 50-mgd desalting plant on the seacoast. Phase 2 of the plan would include those additional units necessary to provide for essentially all of the additional water demands for the next 25 years. Construction would extend through the year 2006. Several alternative plans are outlined.
W70-01558

SURVEY OF OPERATING EXPERIENCES UNDER NEW STATE WATER LAWS,
George E. Ferguson, Harvey O. Banks, John C. Detweiler, and Robert M. Dixon.
Amer Water Works Assoc J, Vol 53, No 8, p 973-978, Aug 1961. 6 p, 2 ref.

Descriptors: *Administration, *Surveys, *Water law, *Water policy, Legal aspects, Legislation, Water resources, Surface waters, Groundwater, Water rights, Water pollution, Water resources development, Water conservation, Water supply, Droughts, Permits, Hydrologic aspects, Hydrologic data, Evaluation, Administrative agencies, Supervisory control (Power).
Identifiers: Flood prevention.

At least twenty-six states have enacted new water laws since 1955; over half of these states created new water agencies. Many of the new agencies are charged with administration of both surface and groundwater, and many have greater authority than the agency which they replaced. Droughts over many areas of the country prior to 1955 may have been a motivating factor in much of the new legislation. Though accounts of operating experience are rarely published, the task group learned through personal interviews that: (1) study groups to recommend needed legislation are widely used and appear to be effective; (2) water legislation is generally too detailed to permit the flexibility needed for the best results; (3) legislation which places the responsibility for the administration of all the water resources of a state in a single agency has proved most effective; (4) local participation in local planning, development, and management is needed; (5) administrators feel a need for adequate hydrologic, economic, and other scientific data; and (6) little could be learned regarding the matter of special rights to water by type of use. (Keith-Florida)
W70-01609

DEVELOPMENT, CONSERVATION AND USE OF WATER RESOURCES.

Va Code Ann secs 10-17.1 thru 10-17.9 (Supp 1968).

Descriptors: *Virginia, *Water resources development, *Administration, *Water conservation, Water resources, Water policy, Administrative agencies, Conservation, Governments, Natural resources, Planning, Resources, Regulation, Riparian rights, Beneficial use, Preferences (Water rights), Coordination, Management, Wildlife conservation, Groundwater, Water pollution control, Pollution abatement, Water pollution, Financing, Aquatic life, Recreation facilities, Legislation.

The Board of Conservation and Economic Development is assigned the responsibility for planning the development, conservation, and utilization of Virginia's water resources. After making a study of the existing water resources and the needs and methods of conservation, the Board shall formulate a coordinated policy for the use and control of the state's water resources. In creating such policy, consideration should be given to: protecting existing rights; providing an adequate and safe water supply; promoting watershed development; protecting wildlife and groundwater supplies from drainage; supporting aquatic life; insuring minimal pollution; and developing water recreation facilities. The Board shall resolve conflicts between state agencies as to water use. It may cooperate with all branches or agencies of the federal government or of any state government and may make technical advice and information on water resources available. In all conservation and water resource matters, the Board may speak for the state. The Board shall have the necessary financial powers to carry out its purpose. (Smith-Florida)
W70-01619

PERMANENT JOINT COMMITTEE ON WATER RESOURCES.
R I Gen Laws Ann secs 22-7.1-1, 22-7.1-3 thru 22-7.1-5 (1968).

Descriptors: *Rhode Island, *State governments, *Water resources development, *Investigations, Water policy, Water resources, Resource development, Conservation, Governments, Water conservation, Water control, Water supply, Water works, Water purification, Water districts, Administrative agencies, Administration, Water requirements, Resources, Distribution, Water rates, Water costs, Desalination, Pipelines, Pipes, Reservoirs, Recreation facilities, Domestic water, Industrial water, Legislation.

A Permanent Joint Committee of the General Assembly on Water Resources is created. Said joint Committee consults and counsels with the state Water Resources Coordinating Board, Water departments and water districts of other governmental bodies and agencies, and with agencies and quasi-municipal corporations dealing with development and operation of water supplies, water control structures, water works, purification plants, desalination methods and plants, water pipe lines, and distribution systems. Said Committee conducts a continuing study and review of water requirements, resources, supplies, methods of acquisition and distribution, and needs and resources of communities. The Committee investigates and desirability of merging water departments and companies, the feasibility of utilizing reservoirs for recreational purposes, and the reasonableness of water rates and charges. The Committee also periodically reports to the general assembly, making recommendations to assure adequate supplies of water for domestic, industrial, agricultural, and recreational use. Said Committee may contract for necessary technical advice. (Smith-Florida)
W70-01626

THE RHODE ISLAND DEVELOPMENT COUNCIL.
R I Gen Laws Ann sec 42-26-15 (1956).

Descriptors: *Rhode Island, *Resource development, *Surveys, *Natural resources, Maps, Resources, Land resources, Conservation, State governments, Governments, Administration, Administrative agencies, Planning, Legislation, Land use, Harbors, Water works, Highways, Water supply, Drainage, Flood control, Sewerage.

The Rhode Island Development Council is authorized to make maps for governmental agencies and to make planning studies and surveys for the collection of data pertaining to soil conditions, land use and classification, port, harbor and waterway work, highways, water supply, drainage, flood control, sewerage, and other matters involved in the physical development of the state or of any subdivision thereof. (Smith-Florida)
W70-01638

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMICS OF PUBLIC WATER PRICING: THE CALIFORNIA CASE,
California Univ., Berkeley.
Michael F. Brewer.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 222-247, 1964. 26 p, 51 ref.

Descriptors: *Water rights, *Pricing, *Economic efficiency, Water rates, Public utilities, Economic evaluation, Dams, Reservoirs, Irrigation, Water resource development, Water supply, Economic analysis, Water districts, Investment, Elasticity of demand.

Identifiers: *California Aqueduct, *Parameters, *Beneficiary payments, Benefit pricing, Marginal monetary utility, Perpetuity contracts.

This article deals with the development of relevant criteria and their application in the evaluation of specific pricing alternatives in public agencies' pricing practices, using water development as a model. Proposals of the state of California to construct, finance, and administer a statewide water development plan are used for illustrative purposes. The economic rationale of this water plan is inferred as the increase of net productivity of the state. Hence, although water development is given special individual attention, public resource developments are frequently integrated with general economic planning. This results in making the purposeful use of water a potentially prominent issue for research and practical implementation, since it is designed to induce particular patterns of population and economic activity. In anticipation of this potentiality, proposals for state pricing policy must be accommodating to future changes which will permit the integration of the California Water Plan into broader economic planning. Perpetuity contracts seem inappropriate to these goals, whereas service by the state would render receipts available for public reinvestment and additional outlays for the plan. (Murphy-Rutgers)
W70-01345

ECONOMIC ANALYSIS IN THE ALLOCATION OF THE FEDERAL BUDGET TO RESOURCE DEVELOPMENT,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 06A.
W70-01346

STATE AND LOCAL GOVERNMENTS AND THEIR BUDGET CONSTRAINT,
Board of Governors of the Federal Reserve System, Washington, D.C.
Edward M. Gramlich.
International Economic Review, Vol 10, No 2, p 163-182, June 1969. 20 p, 3 tab, 15 ref.

Descriptors: *Budgeting, *State governments, *Local governments, Credit, Expenditures, Income, Statistical methods, Model studies, Taxes, Gross National Product, Interest rate, Capital, Debt, Regression analysis.
Identifiers: *Budget constraint, *Budgets, Econometrics, External forces, Grants-in-aid, National accounts budget.

Econometric models have probed many previously unexplored areas of the United States economy. However, there is one sector still relatively untouched by model-builders, and strangely enough, it is a sector which today is generating some of the most heated political controversy, that is, the area of state and local governments. Although there have been many analyses of certain aspects of state and local behavior (both institutional and econometric) on both a micro and a macroeconomic level, none of these analysis have adequately considered the budget constraint under which states and localities operate. These governmental units are generally required to balance their current operating budgets, and they must pay a default risk premium when they make use of credit markets. State and local expenditure and revenue items cannot be analyzed in isolation. The research approach must permit expenditure and revenue policies to be formulated simultaneously and allow them to have mutual ramifications. This study attempts to build such a budget constraint into behavioral descriptions of the components of state and local budgets. The budget constraint proves to have an important effect on the method by which state and local budgets respond to external forces such as movements in GNP, interest rates, and federal grants-in-aid. The paper then presents a statistical estimate of the budget constraint model. Since these governmental bodies are involved in water investment and development projects, this analysis of the role of budget constraints provides the water researchers with insights into effects of macro variables on the water area. (Loeb-Rutgers)
W70-01353

THE LOGIC AND MATHEMATICS OF NON-ANNUAL COMPOUNDING APPLIED TO INVESTMENT DECISIONS,
Michigan Univ., Ann Arbor.
Harry Benford.
The Engineering Economist, Vol 12, No 2, p 67-92, Winter 1967. 26p, 7 fig, 1 tab.

Descriptors: *Mathematical studies, Investment, Interest, Interest rate, Return, Debt.
Identifiers: *Non-annual compounding, *Investment decision, Compound interest.

The author suggests that many of us have grown so used to living with compound interest that we have forgotten its underlying principles. In particular, those who deal in long term investment decisions often grow too accustomed to the simplifying assumption of annual compounding. When confronted with situations in which non-annual compounding must be understood, we often find ourselves confused. The purpose of this paper is to stimulate clear thinking about non-annual compounding and to suggest when and where it may apply. An economic analyst, the author contends, should be able to deal in both nominal and effective interest rates. He should understand how to handle both discrete and continuous returns, and how to find their equivalent interest rates based on annual compounding. This paper should prove valuable to the water researcher involved in the investment decision making process with the associated problems of rate of return, present value of benefits and capital budgeting. (Loeb-Rutgers)
W70-01362

SHARING FINANCIAL RESPONSIBILITY OF RIVER BASIN DEVELOPMENT,
Department of Agriculture, Washington, D.C. Resource Development Economics Div.
M. M. Regan.
Economics and Public Policy in Water Resource Development. Edited by S. C. Smith, and E. N. Castle. Ames, Iowa, State University Press, p 209-221, 1965. 13 p, 10 ref.

Descriptors: *River basin development, *Costs, Direct benefits, Indirect benefits, Capital, Cost-sharing, Cost-benefit analysis, Cost repayment, Economic justification, Project benefits, Project costs, Cost allocation, Rivers, Government.
Identifiers: *Financial responsibility, International rivers.

Sharing financial responsibility of river-basin development involves division of project and program costs among purposes, interests, groups and individuals. These have to be divided between primary and secondary beneficiaries, state or local governments and the national public. This article centers primarily on the approaches, guides and problems involved in the division of project costs among interests and participants. Thus, the objectives to be served and the merits and limitations of alternative basic approaches for apportioning charges or assessments are studied as well as the adjustments and modifications necessitated by problems of practical application and acceptability. The author recommends that requirements be established to serve more specific objectives than is presently the case to achieve optimum resource development and use and to promote desired incidence, distribution and stabilization policies. In establishing requirements for most project purposes, greater emphasis should be placed on charges and assessments based on value of services and less on the computed cost of providing services. (Murphy-Rutgers)
W70-01363

COMMONALITY, THE PRICE SYSTEM, AND USE OF WATER SUPPLIES,
Florida State Univ; Tallahassee.
Jerome W. Milliman.
The Southern Economic Journal Vol XXII, No 4, p 426-437, April 1956, 12p.

Descriptors: *Economics, *Pricing, *Water resource allocation, *Costs, Water supply, Taxes, Government, Return to scale, Water reuse, Marginal cost, Optimization, Proration, Legal aspects, Water demand.
Identifiers: *Commonality, *Spill-over costs, Quotas, Social costs, Costs of production.

This paper seeks to show that greater reliance should be placed upon the price system to allocate water resources efficiently among the competing uses and users. Water as a resource or factor of production has no unique qualities which should cause it to be treated differently from any other economic resource. The major deterrent to the increased use of the price system to allocate water resources is the fact that water resources are utilized in common, giving rise to the problem of spill-over costs discussed in the article. The two major lines of analysis are: (1) The adjudication of specific water rights through the setting of titles; or (2) The imposition of extraction of use taxes designed to correct the divergence between private and social costs. Each method is discussed and it is stressed that the commonality problem must be dealt with so that the price system can aid in the optimum allocation of water resources. (Murphy-Rutgers)
W70-01364

COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL',
Montana State Univ., Bozeman.
Oscar R. Burt.
Water Resources Research, Vol 5, No 4, p 905-907, August 1969. 3p, 1 fig, 6 ref.

Descriptors: *Water pollution control, *Water pollution, *Benefits, Demand, Sport fishing, Recreation demand, Social values, Recreation, Costs, Recreation facilities, Prices, Cost-benefit analysis.
Identifiers: *Recreation benefits, *Consumer surplus, Willingness to pay, Marginal social value, Marginal social cost, Gross benefits, Gross social value.

The author comments on an article and note by Joe B. Stevens pertaining to two alternative measures of benefits associated with water pollution control in a sport fishery. The purpose of this note is to present a third measure and to show that the other two measures are of doubtful logical validity. The two measures of benefits attributable to pollution prevention by Stevens he calls (1) increased consumer surplus and (2) increased willingness to pay. The definition of consumer surplus was taken from Marshal and willingness to pay from Marglin. Stevens' analysis is applied to a graph showing two demand curves: D sub o corresponding to low pollution and D sub 1 corresponding to high pollution. In Stevens' note he is only concerned with a procedure for measuring the gross benefits of pollution control. Stevens apparently felt it necessary to infer social value from only D sub 0 and used D sub 1 only to determine quantity taken at a zero price under polluted conditions. The author feels that the discrepancy in benefits associated with pollution control that Stevens found when using the two criteria is a result of his dubious method of applying the two criteria. The author then presents a generalized framework for analysis which permits evaluation of pollution control under the assumption of optimum pricing. Here, the difference in net values associated with polluted and unpolluted water measures the social reward from pollution control when recreation facilities are optimally priced. This net social value could then be compared with the initial investment cost of pollution control in some sort of benefit-cost framework. (Loeb-Rutgers)
W70-01366

THE INTERNAL RATE OF RETURN AS A RANKING CRITERION,
Michigan Univ., Ann Arbor; AND Stanford Univ., Calif.
James C. T. Mao.
The Engineering Economist, Vol 11, No 4, p 1-13, Summer 1966. 13p, 2 fig, 8 ref.

Descriptors: *Investment, Decision making.
Identifiers: *Internal rate of return, *Ranking criterion, Net present value, Reinvestment rate, Marginal investment return, Fisherian intersection.

In two recent articles, Teichroew, Robischeck, and Montalbano investigated the net present value (NPV) and the internal rate of return (IRR) criteria for accepting or rejecting investment alternatives available to a firm. The accept-reject decisions are the only investment decisions with which a firm need be concerned provided its capital is not rational and its investments are not mutually exclusive. Realistically, however, firms must frequently choose among mutually exclusive investments and more often than not have only limited access to the capital market. When these conditions prevail, optimal decision procedure requires that each investment be appraised both on its own merit and in relation to the merits of any other competing investments. For such appraisals, the management needs not only a rule for classifying investments into acceptable and unacceptable projects but also a criterion for ranking investments in the order of their profitability. The purpose of this paper is to compare the NPV and the IRR as a criterion for ranking competing investments. This article may provide the water researcher with an analysis to decide between investment alternatives embodying different technologies or different project objectives. (Loeb-Rutgers)
W70-01370

SOME MANAGERIAL INFLUENCES ON A FIRM'S PRICING POLICY,
Lancaster Univ., Bailrigg (England).
A. J. Burkart.
Journal of Industrial Economics, Vol 17, No 3, p 180-187, July 1969. 8p.

Descriptors: *Pricing, Demand, Costs, Budgeting.
Identifiers: *Managerial influence, *Pricing policy, Administrative deterrents, New products, Irrationalities.

The author discusses certain factors influencing a firm's pricing policy, which arise more from the way a firm is run than from the way it reacts to changes in the market. The author argues that managerial influences tend to militate against a flexible pricing policy, or a policy that recognizes and seeks opportunities to vary, upwards or downwards, the prices of the firm's products. A firm will determine a price which seems to it appropriate and an estimate of market demand will only be one consideration in this process. The author argues that a firm's prices will be set at a level arrived at in practical terms by successive adjustments from previous historical levels and possibly without much explicit consideration of market demand. Generally, rising costs are a more potent factor in the raising of prices than is buoyant demand. The author then discusses certain managerial influences tending to incline a firm to keep intact its current prices and price structure. This paper, therefore, may provide alternative treatments to the pricing decisions of water supply systems instead of relating water pricing policies to conventional microeconomic demand analysis. (Loeb-Rutgers)
W70-01371

UNEMPLOYMENT AND COST-BENEFIT ANALYSIS,
Pennsylvania Univ., Philadelphia; Princeton Univ., N.J.; and Rochester Univ., N.Y.
Nevins D. Baxter, E. P. Howrey, and R. G. Penner.
Public Finance, Vol 24, No 1, p 80-88, 1969.

Descriptors: *Unemployment, *Cost-benefit analysis, Employment, Benefits, Costs, Interest rate, Prices.
Identifiers: *Local employment, Target employment rate, Geographical distribution, Regional employment, Public projects.

The standard works on cost-benefit analysis are somewhat ambivalent on whether the presence of unemployment warrants an adjustment to the usual calculation of benefits and costs. Eckstein points out that the government will usually have a long list of projects which can be justified on the basis of cost-benefit calculations made under the assumption of full employment. He argues that they should simply proceed somewhat further down the list in times of unemployment. However, if there are not a sufficient number of projects which qualify under the full employment assumption, he suggests that the benefit-cost ratios be adjusted upward by using a lower interest rate and by adjusting raw material and factor prices downward. McKean agrees that unemployment warrants some adjustment of benefit-cost estimates, but suggests that practical problems preclude incorporating the effects of unemployment in the calculation. Prest and Turvey adopt McKean's position but argue that some adjustment might be warranted if unemployment exists in the locality of the project. This note argues that there are conceptual as well as practical reasons for not adjusting benefit-cost estimates to reflect national unemployment levels. The calculation of local employment effects is also considered with particular reference to whether these effects should be counted as part of the total benefits. This should prove applicable to the water area since cost-benefit analysis is employed in the decision making process for many water investment projects. (Loeb-Rutgers)
W70-01375

NUCLEAR DESALTING - FUTURE TRENDS, AND TODAYS COSTS,
Applied Research and Engineering Ltd., Durham (England).
For primary bibliographic entry see Field 03A.
W70-01535

THE LARGE PLANT CONCEPT,
Kellogg M. W. Co., New York.
L. Axelrod, R. E. Daze, and H. P. Wickham.
Chem Engr Progr 64 (7), 17-25, 1968. 9 p, 10 fig.
Identifiers: *Chemical production, *Economic evaluations, *Operating experience, Multipurpose plant, Operational problems, Plant factor, Startups.

Factors affecting the economics and operating problems encountered in installing large plants are reviewed. Comparisons are presented for the investment and manufacturing costs of medium and large size fluid catalytic cracking units, ethylene plants and ammonia plants. In the case of the cracking units and ethylene plants, operating cost savings in the larger plants are almost entirely due to the effect of scale on investment. However, for ammonia plants, larger plants permit the use of centrifugal compressors with turbine drives which permit significant heat recovery within the process. The maximum size of large plants doubles every five years. The startup times and stream factors experienced for 17 large ammonia plants are given. Two-thirds of the plants were making product within 45 days and were at full capacity after 65 days. Problems that have reduced stream factors in cracking plants are reviewed along with the effect of average stream factor over a four-year period of operation on the interest rate of return.
W70-01555

BRIDGE REVENUE BOND ACT.

Miss Code Ann secs 8448-8469.5 (1956), secs 8469.5-01 thru 8469.5-09 (Supp 1968).

Descriptors: *Mississippi, *Bridges, *Bridge construction, *Financing, Civil engineering, Capital, Financial feasibility, Government finance, Local governments, State governments, Costs, Construction costs, Condemnation, Legislation, Legal aspects, Construction, Mississippi River.

Any county or city is authorized to acquire by purchase or condemnation and to construct, improve, or operate Mississippi River bridges which are wholly or partly within such county or city or are within twenty miles thereof. Revenue bonds may be issued to finance the cost of such bridges, provided the bond issue is approved by a majority of the electorate. No bridge for the use of the traveling public or ferry may be constructed or operated within fifteen miles of a toll birdge financed by revenue bonds under this act unless permission is given by the state highway commission. A bridge commission may be formed by the governing authorities of a city or county which has acquired or constructed a bridge authorized by this act and has issued revenue bonds to finance the acquisition or construction. The commission shall serve at the pleasure of the governing authority of the political subdivision and shall be empowered to supervise and maintain the bridge as a separate proprietary venture. (Kelly-Florida)
W70-01599

6D. Water Demand

WATER SUPPLIES FOR COULEE DAM NATIONAL RECREATION AREA, WASHINGTON,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02E.
W70-01244

WATER USE IN THE UNITED STATES IN 1965,
Geological Survey, Washington, D.C.
C. Richard Murray.
J Amer Water Works Ass, Vol 61, No 11, p 567-571, Nov 1969. 5 p, 8 fig, 4 tab, 6 ref.

Descriptors: *Water utilization, *Consumptive use, Industrial water, Municipal water, Domestic water, Irrigation water, Water supply, Data collections, Hydrologic data, Reviews, Surveys.
Identifiers: US Water use (1965).

Data on water consumption in 1965 in the US were compiled by the USGS from readily available sources and a summary article was prepared from that report. Estimates are given of the quantity of water used in the states and water-use regions of the US for public, rural, irrigation, self-supplied industrial, and hydroelectric uses. Consumptive use is also estimated. In 1965, about 310,000 mgd were withdrawn for all uses except hydroelectric power. Of this water, about 78,000 mgd were consumed. About 2,300,000 mgd were withdrawn for hydroelectric power. Industrial withdrawal was about 170,000 mgd, about 125,000 mgd of which was fresh and 45,000 mgd saline. Irrigation withdrawals were about 120,000 mgd, public supplies used 24,000 mgd and rural uses, 4,000 mgd. Groundwater supplied about 20% of all withdrawals. Of 78,000 mgd consumed, irrigation used 66,000 mgd, public supplies 5,200 mgd, and rural, 3,200 mgd. (Knapp-USGS)
W70-01260

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01301

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN

CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01302

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01303

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 04A.
W70-01304

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01305

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 06E.
W70-01306

COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL',
Montana State Univ., Bozeman.
For primary bibliographic entry see Field 06C.
W70-01366

AN INDUSTRIAL WASTE GUIDE TO THE COTTON TEXTILE INDUSTRY.

AATCC, Nat Stream Sanitation Comm and Nat Tech Task Comm on Industrial Wastes, Publ Health Serv pub 677, 1959. 3 p.

Descriptors: *Cotton, *Sludge disposal, *Filtration, *Neutralization, *Remedies, *Aeration, Waste water disposal, Waste water treatment, Activated sludge, Lagoons, Separation techniques, Chemical presepitation.
Identifiers: *Biological oxidation, *Slashing wastes, *Dyeing wastes, *Desizing wastes, *Scouring wastes, *Equilization, *Chemical oxidation, Trickling, Filters, Waste volume reduction, Process modification, Recovery (Wastes), Substitution of chemicals.

This publication is intended primarily to assist the operators and managers of cotton textile processing plants to utilize, reduce and otherwise suitably dispose of their waste waters. Contents: introduction, description of process; sources; characteristics, and pollution effects of process wastes; remedial measures; the solution of specific waste problems; summary and bibliography. (Goodwin-North Carolina State Univ)
W70-01492

REPORTS ON THE PROGRESS OF APPLIED CHEMISTRY - 1963.

Soc of Chemical Industry, p 795, Vol XLVIII.

Descriptors: *Detergents, *Biodegradation, *Legislation, *Activated sludge, *Sludge treatment, Industrial wastes, Sewage, Fish, Instrumentation, Toxicity.
Identifiers: ABS, Molecular structure, Non ionic surfactants.

Contents include the following reviews: Dyestuff Intermediate and Fluorescent Brightening Agents, by M. C. Clark and E. Brunner, p. 14-37; Dyestuffs, by C. V. Stead, p. 38-56; Synthetic Fibers (polyolefin fibers), by G. W. Taylor, p 195-202; Synthetic Fibers (acrylic fibers), by V. Furness, p. 202-208; Bleaching, Dyeing and Finishing, by J. T. Marsh, p. 209-220; Sewage, Trade Wastes, and River Pollution, by J. McNicholas, p. 322-333; and Biodegradability of Detergents, by D. W. G. Dicker, p. 334-342.
W70-01506

NUCLEAR ENERGY CENTERS - INDUSTRIAL AND AGRO-INDUSTRIAL COMPLEXES,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03E.
W70-01560

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
Fletcher N. Baldwin, Jr.
U Fla L Rev, vol 16, no 3, p 370-423, Winter 1963, 54 p, 242 ref.

Descriptors: *Water resources development, *Governments, *Federal-state water rights conflicts, *Relative rights, Federal government, Multiple-purpose projects, Natural resources, Planning, Political aspects, Legal aspects, State governments, Water conservation, Water resources, Water supply, Water rights, Riparian rights, Jurisdiction, Navigable rivers, Navigable waters, Navigation, Non-navigable waters, Compensation, Federal jurisdiction, Water policy, Obstruction to flow, Prescriptive rights, Water pollution.
Identifiers: *Commerce clause.

The federal resources development program has been made possible largely by the United States Supreme Court's development and interpretation of the commerce clause. The federal government now has complete control over navigable waters and qualified control over non-navigable waters. Federal power or dominant servitude has extinguished riparian rights of individuals and of the states if either limited federal control. Certain riparian interests may be taken without compensation on both navigable and non-navigable waterbodies. Riparian owners do not want to give up state-granted water rights, and state action and cooperation is preferred, but in the absence of state initiative the federal government must act to preserve the nation's critical water supply. The national government can take away riparian rights, and the commerce clause is useful in justifying federal encroachment, but in settling conflicts the Supreme Court continues to be the ultimate water law agency. The riparian rights doctrine must be altered for efficient use of the water supply. It is time for serious federal-state cooperation in working out solutions to water problems facing the nation at both levels of government. (Douberley-Florida)
W70-01593

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
Fletcher N. Baldwin, Jr.
U Fla L Rev, Vol 16, No 3, p 370-388, Winter 1963.

Descriptors: *Navigable waters, *Non-navigable waters, *Federal-state water rights conflicts, *Tributaries, Water resources development, Navigation, Navigable rivers, Judicial decisions, Streams, Riparian waters, Riparian rights, Relative rights, Rivers, Multiple-purpose projects, Flood control, Federal government, Federal jurisdiction, Regulation, Legal aspects.
Identifiers: *Commerce clause, Constitutional law.

The development and interpretation of the commerce clause by the Supreme Court has laid a foundation that allows the federal government to provide for the optimal utilization of the water resources available. Justice Marshall declared that the regulation of commerce was the regulation of commercial navigation, and federal authority was quickly extended to all navigable waters, exclusive of state interference. This authority was broadened to non-navigable tributaries, if water commerce was affected, and to streams with even a potential availability for navigation. Where riparian rights in any way limited federal control, they were extinguished. If shown that a stream could be made navigable by reasonable improvements, that Congress intended some benefit to commerce, or that projects along a non-navigable tributary somehow aided navigation, Congressional exercises of power would be upheld. Flood control and waterway development were added to the maintenance of navigation as legitimate constitutional objectives. (Douberley-Florida)
W70-01594

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
Fletcher N. Baldwin, Jr.
U Fla L Rev, Vol 16, No 3, p 388-403, Winter 1963.

Descriptors: *Navigable waters, *Non-navigable waters, *Compensation, *Damages, Navigable rivers, Federal-state water rights conflicts, Riparian rights, Diversion, Riparian land, Tributaries, Ownership of beds, River beds, Access routes, Banks, High water mark, Bank erosion, Flood damage, Project purposes, Federal government, Legal aspects, Obstruction to flow, Alteration of flow, Regulation, Control.
Identifiers: Dominant servitude, Harbor lines.

The power to regulate and improve navigable waters has created a dominant servitude in favor of the federal government. The government is not held responsible for any damage caused to private riparian property as a direct result of the regulation and improvement of navigable waters. On the other hand, compensation may be awarded to riparians on a non-navigable tributary of the improved navigable waterbody. The navigable servitude doctrine is also extended to non-navigable streams as long as improvements are necessary for the improvement of navigation in the connecting watercourse. The power to establish harbor lines limits the construction of state and private structures to within established areas, but there is no compensation for financial hardship as long as the government does not actually injure or physically take property. The riparian's right to access may also be destroyed without compensation. There is no compensation for injury to riparian embankments caused by alteration of flow by dams, and flood damage may be declared an act of nature. The Court, as the ultimate water law agency, may well eliminate the distinctions between navigable and non-navigable streams. (Douberley-Florida)
W70-01595

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
Fletcher N. Baldwin, Jr.
U Fla L Rev, Vol 16, No 3, p 403-423, Winter 1963.

Descriptors: *Water resources development, *Federal-state water rights conflicts, *Project planning, *Water utilization, Political aspects, Relative rights, Riparian rights, Navigable waters, Non-navigable waters, State governments, Federal government, Water management (Applied), Water conservation, Planning, Social function, Water rights, Cooperatives, Judicial decisions.

Identifiers: *Federal-state cooperation.

The expanding interpretation of the commerce clause must conform to the needs of national water problems, whether it was intended to be extended to non-navigable streams or not. States may have the best access and control of water, but the federal government also has a concern in remedying the critical water resources problem. Lack of aggressive state action continues to force the federal government to plan for and counter these problems, and so long as federal activity presents some aspect of proper federal control the courts will not restrict it. Water rights of the states as well as of the individual are limited by federal supremacy, but state activity has been allowed where Congress has elected not to intrude. States are also given a voice in federal-state cooperative projects, but this cooperation has been severely inadequate. Where federal-state conflicts cannot be resolved, the Supreme Court will support the federal government, but the court should not be the ultimate water law agency. Serious cooperation is needed in working out a more efficient system of water use and management and especially in altering the riparian rights doctrine. (Douberley-Florida)
W70-01596

WATER AND WATER COURSES - LAND-LOCKED NON-NAVIGABLE LAKES - OWNERS RESTRICTED TO REASONABLE USE.

Rutgers L Rev, vol 14, no 4, p 837-840, Summer 1960, 4 p, 27 ref.

Descriptors: *Florida, *Non-navigable waters, *Relative rights, *Reasonable use, Civil law, Water policy, Right-of-way, Access routes, Lakes, Competing uses, Domestic water, Natural use, Obstruction to flow, Recreation, Riparian rights, Boundaries (Property), Lake beds, Lake shores, Ownership of beds, Judicial decisions.
Identifiers: Common law.

Defendants were owners of riparian land adjacent to plaintiff's riparian lands. Said properties extended to and underlay a corner of a land-locked, non-navigable lake. Defendants erected water barriers along the boundaries of their submerged lands, thereby eliminating plaintiff's use of that portion of the lake overlying defendant's fee. The Florida court ordered that the enclosures be removed. In so ruling, the court adopted the civil law rule, which holds that each riparian owner has a right of access to the entire lake instead of the common law rule, which states that each riparian owner has absolute control of the water which overlies his fee. This preference for the civil law rule was based on grounds of public policy in a water-oriented resort state. However, the court failed to discuss the inequity of allowing each owner full use of the lake despite possible discrepancies in the comparative size of the various holdings. While the theory of reasonable use, as part of the civil law rule, is appropriate for running waters, it is suggested that a better test would involve the reasonable man in a similar position; this would take into account defendant's motives. (Smith-Florida)
W70-01627

6E. Water Law and Institutions

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967. 66 p, 133 ref.

Descriptors: *New York, *Alteration of flow, *Reasonable use, *Preferences (Water rights), Legislation, Planning, Water resources development, Riparian land, Riparian water, Riparian rights, Water rights, Natural flow doctrine, Competing uses, Domestic water, Natural use, Obstructions to flow, Relative rights, Bodies of water, Water users, Water utilization, Water allocation (Policy), Water policy, Water pollution, Legal aspects.
Identifiers: Trespass, Negligence.

A number of additions to the New York conservation law are proposed by the Cornell Water Resources Center. It is proposed that a riparian owner should have no cause of action for damages against a co-riparian who alters the natural flow, quality, quantity, or condition of a body of water to further the use and enjoyment of riparian property, so long as the alteration is reasonable. The same privilege to make alterations should be extended to include an alternative of furthering the use of non-riparian land. The factors that should be considered in determining the reasonableness of harm are outlined. The proposals are not to affect actions for negligence or trespass and do not affect pollution laws or injunctions by governmental bodies. Each proposed section is accompanied by comments on the desirability of the legislation, its need in the state, and its constitutionality in the face of anticipated attacks. (Douberley-Florida)
W70-01301

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 5-6, p 13-17, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Alteration of flow, *Reasonable use, *Riparian rights, *Preferences (Water rights), Lakes, Streams, Water resources development, Natural flow doctrine, Relative rights, Streamflow, Water quality, Riparian land, Riparian waters, Water rights, Competing uses, Prior appropriation, Priorities, Artificial use, Obstructions to flow, Bodies of water, Water utilization, Legal aspects.

The Cornell Water Resources Center proposes a number of additions to the New York conservation law for the purpose of reducing uncertainties in the state common law concerning rights of riparians on streams and lakes. Such additions would enable private parties to undertake water-connected projects while being sure of their rights, and draftsmen of water resources development statutes may better determine legal obstacles with reasonable certainty. Section 429-k of the proposal provides that an alteration in the natural flow, quantity, quality, or condition of a body of water by a riparian owner to further the use and enjoyment of riparian property may not give rise to a cause of action if the alteration is reasonable, even though it is causing real or substantial harm to others. The establishment of reasonableness in a particular circumstance is preferable to definite rules that cannot cover the infinite number of conceivable situations. The rule that makes an alteration harmful if it harms a co-riparian gives a permanent advantage to the riparian who first exercises his riparian rights, in violation of established principles of the riparian doctrine, and imposes a rigidity that makes it difficult to meet new water needs. (Douberley-Florida)
W70-01302

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 17-32, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Water rights, *Public benefits, *Riparian rights, *Preferences (Water rights), Water pollution, Cities, Compensation, Benefits, Comparative benefits, Relative rights, Projects, Project planning, Regulation, Legal aspects.
Identifiers: Harmful use, Water rights impairment, Constitutional law.

Proposed section 429-k does not affect enforcement of pollution statutes, and it is needed to counter uncertainty created by dicta that might allow an opposite interpretation of existing law. Constitutional challenges that the rights of those harmed are deprived without just compensation are not plausible because the proposal is a valid exercise of the police power in furtherance of the public interest, and the impairment of rights is so small as not to constitute a taking. The public interest greatly outweighs the incidental harm to rights of riparians. The state is not depriving riparians of rights but is merely readjusting rights among co-riparians. Although recent decisions may present some problems with overly broad language condemning similar provisions, no court has struck down a statute that destroys a cause of action only for injury suffered as the result of a reasonable activity. (Douberley-Florida)
W70-01303

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
For primary bibliographic entry see Field 04A.
W70-01304

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 9-11, p 38-57, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Reasonable use, *Public benefits, *Relative rights, *Preferences (Water rights), Alteration of flow, Natural streams, Lakes, Regions, Access routes, Priorities, Regulation, Riparian land, Riparian waters, Riparian rights, Diversion, Obstruction to flow, Water resources development.
Identifiers: Malicious acts.

Section 429-m lists the factors that should be considered in determining the reasonableness of harmful alterations in watercourses and lakes. These considerations should include: (1) suitability to the region, in view of custom; (2) relative importance to the public; (3) amount of harm caused, although a finding of greater harm than an alternative is not determinative; (4) ease of minimizing or avoiding harm; (5) location of the contestants' points of access; (6) priority in time of the commencement of activities, although priority does not necessarily establish reasonableness; and (7) motive of the person effecting alterations, although only a primarily malicious motive is determinative. No alteration should be classified as unreasonable as a matter of

law because of its nature or consequences. This section codifies the principle of variability in response to changing conditions, which is valuable in meeting changing water needs. The public interest in developing water resources outweighs the right of riparians to be free from reasonable harm. The provision should be made retroactive. Constitutional challenges may be met as a permissible exercise of the police power, since only small expenditures by the challenger would probably be involved. (Douberley-Florida)
W70-01305

STUDY AND REPORT IN SUPPORT OF LEGISLATION CONCERNING HARMFUL ALTERATIONS IN, USES OF, AND ACTIVITIES IN CONNECTION WITH WATERCOURSES AND LAKES.
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

Study and Report in Support of Legislation Concerning Harmful Alterations in, Uses of, and Activities in Connection with Watercourses and Lakes, p 11-12, p 58-66, (A Revision of Preliminary Report of Feb 1, 1967), Feb 28, 1967.

Descriptors: *Alteration of flow, *Riparian rights, *Municipal water, *Water utilization, Natural flow doctrine, Riparian land, Riparian water, Reasonable use, Public benefits, Domestic water, Cities, Compensation, Artificial use, Flooding (Intentional inundation), Flood damage, Bodies of water, Beds under water, Legal aspects, Surface waters.
Identifiers: Negligence, Trespass.

According to section 429-n, nothing in the proposed provisions will affect common law actions against a person who effects an alteration in a negligent manner. The determinative factors for negligence are similar to those used in determining reasonableness, including whether the risk of harm is unreasonable in view of the social value, whether less dangerous methods could be used, or whether the conduct is customary. The riparian's right to freedom from personal intrusion and the common law rule that domestic uses are reasonable as a matter of law remain intact. Municipal rights are not altered, and it is doubtful that existing law allows a municipality to take water without compensating riparians. Section 429-o does not increase the instances where a person may enter riparian land, above or below the surface or may cause harm by flooding another's dry land. The common law domestic use doctrine is not altered. (Douberley-Florida)
W70-01306

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-01307

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-01308

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-01309

BEACHES.

Miss Code Ann sec 2018.7 (Supp 1968).

Descriptors: *Mississippi, *Beaches, *Recreation, *Recreation facilities, Shores, Sands, Lakes, Public health, Safety, Lake shores, Seashores, Coasts, Inland waterways, Legislation, Recreation wastes, Disposal, Waste disposal.

For the purpose of this act, 'established beach' shall include any sand beach, natural or man-made, along any natural coastline or inland lake, designated or used for public recreational purposes. (Schram-Florida)
W70-01310

USE OF LICENSE FEES; FISH RESTORATION PROJECTS.
Va Code Ann sec 29-1.1 (1969).

Descriptors: *Virginia, *Administrative agencies, *Fish management, *Fish reproduction, Fisheries, Federal government, State governments, Fish conservation, Permits, Fish stocking, Political aspects, Regulation, Administration, Conservation, Coordination, Legislation, Financing.

License fees of fishermen are used for the administration of the Division of Fish and Game and for fish preservation. Fish restoration projects that comply with regulations of the Secretary of the Interior may not conflict with state laws. (McDonough-Florida)
W70-01311

SAMPLING FOR WATER POLLUTION.
For primary bibliographic entry see Field 05G.
W70-01312

LICENSE TAXES AND REQUIREMENTS TO TAKE SHELLFISH.
Va Code Ann secs 28.1-119 thru 28.1-123 (1969).

Descriptors: *Virginia, *Permits, *Taxes, *Commercial shellfish, Tax rate, Oysters, Clams, Shellfish, Commercial fishing, Administrative agencies, Fisheries, Conservation, Fish conservations, Legislation.
Identifiers: Residency requirements.

The state graduated license tax on persons, firms, and corporations engaged in the business of shucking or packing oysters is based on the volume of business during the license period. The tax is computed on written volume reports filed by the licensee in January of each year. False reporting constitutes a misdemeanor. This license tax is in lieu of all state taxes on the capital of the business. Persons wishing to take or catch oysters or clams by hand or tongs from areas not leased for oyster planting purposes must be licensed and have the license available for inspection. Licensing requirements do not attach to persons taking clams or oysters for immediate household use. Non-residents are those persons not paying state taxes, not residing in the state over a year, or landowners not residing in the state over four months. Non-residents taking or planting oysters for market or profit are guilty of a misdemeanor. It is a misdemeanor for citizens of this state to be interested with any non-resident in the commercial taking of fish or shellfish or oyster planting in state waters. (McDonough-Florida)
W70-01313

CRABS.

Va Code Ann secs 28.1-165 thru 28.1-174 (1969).

Descriptors: *Virginia, *Commercial fishing, *Commercial shellfish, *Crabs, Taxes, Permits, Inspection, Control, Regulation, Administrative agencies, Dredging, Legislation, Legal aspects, State jurisdiction, Fish conservation, Supervisory control (Power), Fisheries.

Persons desiring to take crabs for market or profit from the waters of the state and persons engaging in the business of buying or marketing crabs must pay an annual license tax. The amount of the tax varies according to the method and scale of the crab fishing. Use of scrapes and dredges for catching crabs is prohibited during a specified season. The Commission of Fisheries may modify the prohibition in certain circumstances. Crabs must surpass certain size limitations before they may be retained when caught. The inspector for each district may examine any catches to determine whether the crabs therein meet statutory size requirements. The number of crabs that can be taken by one boat in one day may be limited at the Commissioner's discretion. Sponge crabs may not be taken from May to September within a certain geographical area. Crabs generally may not be taken commercially on Sunday or at night. Crab traps or pounds must be placed at least one hundred yards apart and must be completely removed from the water at the end of each season. Anyone may take up to one bushel of crabs per day for household use without obtaining a license. (Kelly-Florida)
W70-01314

HEALTH PROVISIONS: FISH AND SHELLFISH.
Va Code Ann secs 28.1-175 thru 28.1-183.1 (1969).

Descriptors: *Virginia, *Commercial fishing, *Commercial shellfish, *Public health, Fish conservation, Water pollution, Fish management, Environmental sanitation, Environmental effects, Regulation, Administrative agencies, Control, Inspection, Permits, Shellfish, Legislation, Legal aspects, Supervisory control (Power).

The State Health Commissioner is authorized to examine fish and shellfish in planting grounds and in packing houses within the state or in other places from which the fish and shellfish are to be taken or sold for food purposes. He may survey the sanitary conditions and pollution hazards adjacent to and within shellfish growing areas and within packing houses and plants for the purposes of protecting the industries and the public health and preventing the sale of fish and shellfish deemed unfit for market. The Health Commissioner shall notify the Commissioner of Fisheries of any findings of unfit fish or shellfish and of unsanitary or polluted conditions. He shall also notify any affected owner of fishing grounds or plant operator and may enjoin further operation and/or fishing until corrections are made. Polluted fish or shellfish grounds may be condemned seasonally or indefinitely by the State Health Commissioner. Areas may be closed in emergencies without recourse to hearings. Some replanting may be permitted of shellfish from condemned areas under close Commission supervision. All oysters and clams imported from other states must have been certified fit for market. The Fisheries or Health Commissioners may seize goods caught and/or sold contrary to this statute. (Kelly-Florida)
W70-01315

ENFORCEMENT OF FISH AND SHELLFISH REGULATIONS.
Va Cpde Amm secs 28.1-184 thru 28.1-194 (1969).

Descriptors: *Virginia, *Commercial fishing, *Regulation, *Commercial shellfish, Maryland, Bays, Tidal waters, Fish conservation, Fish management, Shellfish, Legislation, Legal aspects, Inspection, Investigations, Permits, Control, Administrative agencies, Supervisory control (Power), Political aspects, Water policy.
Identifiers: Chesapeake Bay, Interstate cooperation.

The Commission and Commissioner of Fisheries, all inspectors, police captains of boats, and other authorized agents may arrest any violator of the state's fish or shellfish laws with or without a warrant. They may, further, seize any vessel and/or cargo pursuant to enforcement of these laws. Violations of the fish or shellfish laws constitute misdemeanors. Maryland authorities attempting to make arrests or seizures for violation of Maryland fish and shellfish laws may cross the Virginia-Maryland boundary in the Chesapeake Bay to make such arrests. No person may use any drag box, tub, or sack for taking fish or shellfish in the state; possession of such a device carries a presumption of guilt. Licenses and names of boats registered for purposes of this chapter must be kept in plain view. No inspector or other officer apprehending any person

for any violation of fish or shellfish laws is authorized to settle with such offender or release him from any resulting legal proceedings. (Kelly-Florida)
W70-01316

VIRGINIA INSTITUTE OF MARINE SCIENCE.

Va Code Ann secs 28.1-195 thru 28.1-200 (1969).

Descriptors: *Virginia, *Investigations, *Research facilities, *Water resources development, Fish conservation, Commercial fishing, Recreation, Administrative agencies, Foundation investigations, Data collections, Exploration, Planning, Feasibility, Surveys, Legislation, Legal aspects, Atlantic Ocean, Tidal waters, State jurisdiction, Fisheries, Marine fisheries.
Identifiers: Marine pollution.

The Virginia Institute of Marine Sciences shall be continued as an independent research and service agency. The duties of the Institute include conducting investigations of areas used by seafood and sport-fishing industries, advising the Commission of Fisheries regarding conservation of fisheries' resources, studying marine pollution, making hydrographic and biological studies of the tidal waters of the state and contiguous waters of the Atlantic Ocean, and making other studies as requested by the governor. The Institute may enlist the aid of public or private agencies in conducting its studies and research. It may take any marine organism from the waters of the state, with approval of the Commission of Fisheries, for purposes of carrying out its assigned tasks. (Kelly-Florida)
W70-01317

ATLANTIC STATES MARINE FISHERIES COMPACT.

Va Code Ann sec 28.1-202 (1969).

Descriptors: *Virginia, *Interstate compacts, *Fish conservation, *Interstate commissions, Water resources development, Fish management, Atlantic Ocean, Fisheries, Fish stocking, Commercial fishing, Administrative agencies, Wildlife conservation, Legislation, Legal aspects, Regulation, State jurisdiction.

The purpose of the Atlantic States Marine Fisheries Compact is to develop a program for promotion and protection of Atlantic seaboard fisheries and to prevent physical waste of the fisheries from any cause. The Atlantic States Marine Fisheries Commission is hereby created and is composed of representatives from each state adopting the Compact. The Commission is responsible for discovering methods which prevent depletion and waste of fisheries and is empowered to recommend specific coordination of the police powers of the member states. The Commission may draft recommended legislation, advise pertinent administrative agencies, and plan use of jointly stocked waters. The Fish and Wildlife Service of the United States Department of the Interior serves as the primary research agency of the Commission. Nothing in the Compact shall prevent a member state from enacting additional conservation laws, nor shall any provision be construed to repeal a state law. States consenting to an amendment set forth in the Compact may agree to have the Commission serve as a joint regulatory agency for specific fisheries in which such states have a joint interest. (Kelly-Florida)
W70-01318

WATERS OF THE STATE: REGULATION OF INDUSTRIAL ESTABLISHMENTS.
For primary bibliographic entry see Field 05G.
W70-01319

PERMISSION TO CAPTURE FLOODWATERS.
Va Code Ann secs 62.1-107 thru 62.1-115 (1968).

Descriptors: *Virginia, *Riparian rights, *Water storage, *Floodwater, Permits, Average flow, Water permits, Water levels, Riparian land, Ownership of beds, Diversion structures, Watershed management, Administration, Water rights, Legislation, Projects.

Riparian owners wishing to capture floodwaters must apply to the circuit court in the county where the waters will be stored. The Commissioner of Water Resources then prepares a report showing the average flow at the point where the water will be taken, any conflicts with proposed projects in the watershed, and the effects of the proposed capture on pollution abatement. The court bases its decision on the petition and the report. The state consents to the use of watercourse beds to which it has title for the construction of impounding facilities. Riparian owners storing floodwaters have unrestricted use thereof. (McDonough-Florida)
W70-01320

VIRGINIA PORTS AUTHORITY.
Va Code Ann secs 62.1-128, 62.1-132 thru 62.1-134, 62.1-136, 62.1-137 (1968).

Descriptors: *Virginia, *Port authorities, *Harbors, *Navigation, Legislation, Eminent domain, Condemnation, Cities, Maintenance, Administrative agencies, Operations, Operation and maintenance, Construction, Publications, Project purposes, Coordination, Water policy, Income, Leases, Rent, Administration, Docks.
Identifiers: *Commerce.

The Division of Ports of the Department of Conservation and Development is abolished. The Virginia State Ports Authority is created. To unify and promote the development of the port facilities within the municipalities of the state, the governing body of any such city shall have the power to appoint boards of municipal port commissioners. These boards may be delegated any or all of the authority with regard to the ownership, operation, and management of the port terminal facilities within such municipalities. The Board of Commissioners of the Virginia Ports Authority may engage in promoting, developing, constructing, maintaining, and operating the harbors and seaports within the state. The Authority's general purposes include: (1) development of harbors and seaports for the handling of water-borne commerce; (2) improvement of such port facilities and issuance of revenue bonds for this purpose; (3) stimulation of the use of such harbors; (4) issuance of a publication of all port charges, rules, and practices; and (5) performance of any act to increase commerce through such harbors and seaports. The Authority is vested with the power of eminent domain. The Authority may lease such port facilities to the respective city, county, or town. (Schram-Florida)
W70-01321

VIRGINIA BEACH EROSION COMMISSION.

Va Code Sec 62.1-154 (1968).

Descriptors: *Virginia, *Erosion, *Beach erosion, *Erosion control, Legislation, Check structures, Conservation, Jetties, Sea walls, Shore protection, Sands, Beaches, Construction, Maintenance, Right-of-way, Shores, Coastal engineering, Tidal effects, Local governments, Administrative agencies, Cities, Regulation.

The Virginia Beach Erosion Commission shall have all of the powers necessary and convenient to carry out the purposes for which it is created. The general purpose of the Commission is to stop or correct erosion along the Atlantic coast in the city of Virginia Beach. The Commission shall have the power: (1) to construct and maintain jetties, groins, and seawalls; (2) to place sand upon the beach for the purpose of controlling erosion; (3) to acquire land, rights-of-way, sand or any kind of material to attain the objects of the Commission; (4) to improve, beautify, maintain, and preserve the ocean front; and (5) to make rules and regulations not inconsistent with law to carry out the general purposes of the Commission. The council of the city may appropriate such funds as it deems necessary to carry out the purposes of the Commission. The Commission also may: (1) sue and be sued; (2) contract with any person, firm, or corporation; (3) make and execute necessary instruments; and (4) accept and expend any gift, grant, or donation from any public or private source. (Schram-Florida)
W70-01322

SALE OF CORPORATE PROPERTY AND GRANTING OF FRANCHISES BY CITIES AND TOWNS.
Va Const Art VIII, sec 125, 1968.

Descriptors: *Virginia, *Cities, *Leases, *Public lands, Legislation, Legal aspects, Permits, Easements, Public utilities, Docks, Bridges, Railroads, Public rights, Compensation, Competitive prices, Local governments, Grants, Bids, Contracts.
Identifiers: Wharves.

No city or town may sell its rights in and to its water front, wharf property, public landings, wharves, docks, and bridges except by an ordinance or resolution passed by a recorded affirmative vote of three-fourths of all the members elected to the council. No franchise, lease, or right of any kind to use any such public property or easement of any description, in a manner not permitted to the general public, shall be granted for a period longer than thirty years. Before granting any such franchise, the municipality must first, after due advertisement, receive bids therefor publicly. Such grant may provide that, upon termination of the grant, the plant as well as the property thereupon becomes the property of the municipality. The above may be without compensation or upon the payment of fair value, but the grantee is entitled to no payment by reason of the value of the franchise. Such municipality may then sell or lease any acquired plant or property or control and operate the same. (Schram-Florida)
W70-01323

NATURAL OYSTER BEDS.

Va Const art XIII, sec 175, 1968.

Descriptors: *Virginia, *Oysters, *Shoals, *Ownership of beds, Legislation, Beds, Rocks, Leases, Public benefits, Public lands, Public rights, Legal aspects, Regulation, Surveys, Water rights, Withdrawn lands.
Identifiers: *Oyster beds.

The natural oyster beds, rocks, and shoals in the waters of this state shall not be leased, rented, or sold. They shall be held in trust for the benefit of the people of the state and subject to such regulations and restrictions as the General Assembly may prescribe. The General Assembly may, from time to time, define and determine such natural beds, rocks, or shoals by surveys or otherwise. (Schram-Florida)
W70-01324

CONSERVATION OF OPEN SPACES.

R I Gen Laws Ann sec 45-36-1, 45-36-2 (Supp 1968).

Descriptors: *Rhode Island, *Conservation, *Natural resources, Legal aspects, Beaches, Tidal waters, Marshes, Wetlands, Soil conservation, Fish conservation, Water conservation, Adoption of practices, Land management, Condemnation, Parks, Preservation, Scenery, Legislation.
Identifiers: Open spaces.

Open space means any space or area the preservation of which would: maintain or enhance the conservation of natural or scenic resources; protect natural streams or water supply; promote conservation of soils, wetlands, beaches, or tidal marshes; or

enhance the value to the public of abutting or neighboring parks, forests, wildlife preserves, or nature reservations or sanctuaries. Any city may acquire land or interests in land and may enter into agreements for the purpose of maintaining, improving, and protecting future use of open spaces, or otherwise conserving open spaces. (Kelly-Florida)
W70-01325

STATE PARTICIPATION IN FEDERAL NAVIGATION AND FLOOD CONTROL PROJECTS.
For primary bibliographic entry see Field 04A.
W70-01326

CONTROL OF BEACH EROSION.

R I Gen Laws Ann secs 46-3-7 thru 46-3-10 (1956).

Descriptors: *Rhode Island, *Beach erosion, *Erosion control, *Shore protection, Legislation, Landfills, Erosion, Beaches, Dunes, Breakwaters, Bulkheads, Jetties, Riprap, Retaining walls, Land subsidence, Condemnation, Administrative agencies.

The legislative body of a city or town may designate beach areas requiring protective works such as breakwaters, bulkheads, jetties, and other structures to prevent erosion of exposed beaches. The legislative body must apply for state aid in acquiring lands and interests needed for the project and may cooperate with the Division of Harbors and Rivers to plan and finance the appropriate protective works. The Division of Harbors and Rivers may obtain needed properties by condemnation if other methods of acquisition are impossible. (McDonough-Florida)
W70-01327

PROHIBITION OF WATER POLLUTION.
For primary bibliographic entry see Field 05G.
W70-01328

ADOPTION OF APPROVED POLLUTION PREVENTION SYSTEMS.
For primary bibliographic entry see Field 05G.
W70-01329

DISCHARGE OF SEWAGE.
For primary bibliographic entry see Field 05G.
W70-01330

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-01331

DRAINAGE--CONDEMNATION FOR DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 04A.
W70-01332

SUBDIVISION ORDINANCES FOR DRAINAGE AND FLOOD CONTROL.
For primary bibliographic entry see Field 04A.
W70-01333

PARKS AND RECREATIONAL AREAS.
RI Gen Laws Ann sec 32-1-3 (1968).

Descriptors: *Rhode Island, *Recreation facilities, *Riparian rights, *Water resources development, Beaches, Facilities, Recreation, Flow, Natural flow, Dams, Dam construction, Condemnation, Eminent domain, Land development, Land management, Administration, Administrative agencies, Boating, Water sports, Fishing, Resource development, Natural resources, Legislation, Parks, Water rights, Conservation.

The Department of Natural Resources may acquire by gift, purchase, condemnation, or devise lands, easements, rights and interests in land for parks, recreation grounds, or bathing beaches in any part of the state, provided that all such property, other than tide-flowed lands acquired by condemnation, shall remain subject to all rights of riparian proprietors on any waters bordering upon such property. All such riparian proprietors have the right to: continue to maintain, repair, or reconstruct dams and appurtenances now existing on such waters; enter upon such property restoring it to its previous condition; and enjoy the same rights of flowage heretofore enjoyed. Subject to these provisions, the Department may permit the use of property acquired under this section and the waters bordering thereon for bathing, boating, fishing, and skating. The Department has the same authority over such lands as it has over other property acquired by law. (Smith-Florida)
W70-01334

REGISTRATION AND REPORTS OF COMMERCIAL FISHERIES.
RI Gen Laws Ann secs 20-7-1 thru 20-7-6 (1968).

Descriptors: *Rhode Island, *Permits, *Boats, *Commercial fishing, Commercial fish, Commercial shellfish, Administrative agencies, Bait traps, Nets, Fishing gear, Legislation, State jurisdiction, Buoys, Fish management, Fish conservation.
Identifiers: Penalties (Criminal).

Owners of commercial fishing boats and devices operating out of this state must register with the Department of Natural Resources. Owners must file monthly reports on the number of pounds of fish caught. Fishing traps and buoys must be tagged with the owner's name and registration number. Violations of this chapter are punishable by fine or suspension of registration. (McDonough-Florida)
W70-01335

ATLANTIC STATES MARINE FISHERIES COMPACT.

RI Gen Laws Ann secs 20-8-1 thru 20-8-12 (1968).

Descriptors: *Rhode Island, *Interstate compacts, *Interstate commissions, *Fisheries, State governments, Federal government, Fish management, Fish stocking, Conservation, Administrative agencies, Water law, Legislation, Political aspects, Maine, New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Commercial fishing, Financing.
Identifiers: Atlantic states fisheries.

The purpose of the Atlantic States Fisheries Compact is to protect fisheries and prevent their physical waste. The Atlantic States Marine Fisheries Commission, composed of three representatives from each member state, recommends conservation practices and methods to avoid fisheries' waste. The Commission may act as a joint regulatory agency for fisheries of the states. It may recommend legislation to the party states and is available to consult with state agencies. The Commission is supported by annual appropriations of member states and may use the United States Fish and Wildlife Service as its primary research agency. (McDonough-Florida)
W70-01336

LICENSING AND REGULATION OF FREE AND COMMON SHELLFISHERIES.

RI Gen Laws Ann secs 20-9-1, 20-9-2, 20-9-6, 20-9-10, 20-9-12, 20-9-13 (1968).

Descriptors: *Rhode Island, *Commercial shellfish, *Shellfish, *Commercial fishing, Permits, Fishing gear, Farm ponds, Fish, Fisheries, Trawling, Administrative agencies, Legislation, State governments, Legal aspects, Boats, Regulation, Fish stocking, Fish farming, Fish reproduction, Aquiculture, Fish conservation, Clams, Oysters, Mussels, Water conservation, Dredging.
Identifiers: *Scallops, Quahaugs.

In order to take oysters, clams, or quahaugs from the free and common fisheries in Rhode Island waters, persons must obtain a license from the Director of Natural Resources. The Director also issues boat registrations for the taking of oysters, clams, and quahaugs and makes and enforces regulations governing registrations and licenses. No person, however, may take oysters from the free and common oyster fisheries between the dates specified. State residents may without a license take as much as one-half bushel of oysters in any one day. The use of dredges for the taking of oysters, clams, quahaugs, scallops, and mussels is herein regulated. Dredging for sea clams or skimmers is permitted in specified areas. This Act establishes number and size limits for shellfish which may be taken. The Director of Natural Resources, in order to preserve and insure the future growth of oysters in Charlestown pond and Green Hill pond, is responsible for transplanting seed oysters to more favorable locations. (Marsee-Florida)
W70-01337

OYSTER GROUND LEASES.

RI Gen Laws Ann secs 20-10-1 thru 20-10-3, 20-10-5, 20-10-7, 20-10-9, 20-10-12, 20-10-19, 20-10-22 (1968).

Descriptors: *Rhode Island, *Leases, *Oysters, *Commercial shellfish, Land tenure, Regulation, Legal aspects, Administrative agencies, Legislation, State governments, Jurisdiction, Shellfish, Aquiculture, Commercial fish, Mollusks, Tidal waters, Land development, Wetlands, Mud flats, Contracts, Rent, Beds, Beds under water, Administration, Supervisory control (Power), Surveys.
Identifiers: *Oyster grounds, Shellfish cultivation.

The Director of Natural Resources may lease oyster grounds, within the limitations and terms herein set forth, for the purpose of oyster culture and business. Lease terms vary depending upon the depth of tidewater covering such grounds at mean low tide. In general, lands must be covered by at least four feet of water. Exceptions are made for specified areas. Deep water leases, where the depth of such waters is at least at twelve feet, are allowed in Naragansett Bay and tributaries. Leases may be renewed. The Director may lease soft or mud bottom lands for the purpose of having such lands made suitable for oyster and shellfish planting and cultivation. It is unlawful for persons to wrongfully make claim upon public oyster grounds, and penalties are provided. Specified grounds are not subject to lease, and special rules exist for given ponds. Before leasing lands, the Director has the lands surveyed, platted, and properly marked with stakes or buoys. The Director supervises the care and removal of such stakes and buoys. Oysters planted or growing in privately leased oyster grounds are the lessee's property. (Marsee-Florida)
W70-01338

ERADICATION OF STAR FISH.

RI Gen Laws Ann secs 20-20-1 thru 20-20-7 (1968).

Descriptors: *Rhode Island, *Fish management, *Pest control, *Water resources development, Animal control, Control, Fishing, Fishkill, Fish, Fish harvest, Wildlife conservation, Spawning, Fish reproduction, Permits, Weight, Dredging, Administration, Adminstrative agencies, Regulation, Government finance, Costs, Financing, Legislation, Supervisory control (Power), Fish conservation.
Identifiers: Star fish eradication.

The general assembly annually appropriates money for the eradication of star fish in the waters of

Rhode Island and for a suitable bounty for such star fish. The controller may draw on the general treasury for such sums approved by the Director of Natural Resources for such purposes. The Director designates fishing zones for star fish, strategically located so as to break up star fish spawning beds. The Department of Natural Resources issues permits for each boat used to dredge for star fish. The bounty must be set between seventy-five cents and one dollar per hundred pounds of star fish, and the Department must designate the locations of three weighing stations to be used in weighing each licensee's catch. No bounty is paid for star fish taken from leased grounds or for star fish dredged by oyster companies. Such fishing is legal only between sunrise and sunset, Tuesday through Sunday, and only approved trawls and dredges are permitted. The Director makes rules and regulations necessary to carry out the provisions of this chapter. (Smith-Florida)
W70-01339

BLASTING REGULATIONS.

Pa Stat Ann Tit 73, sec 166 (Supp 1969).

Descriptors: *Pennsylvania, *explosives, *Standards, *Administration, Control, Governments, Explosions, Highways, Streams, Rivers, Regulation, Administrative agencies, Channels, Permits.

The use of explosives for blasting in the neighborhood of any public highway, stream of water, dwelling house, or pipe line shall be done in accordance with the provisions of this section and rules and regulations promulgated by the Department of Labor and Industry. Standards for blasting and standards for instruments for determining the particle velocity of blasts are established. Blasting near streams is prohibited in all cases where the effect of the blasting is liable to change the course or channel of any stream, unless a permit is first obtained from the Department. (Smith-Florida)
W70-01340

THE ROLE OF THE PUBLIC DISTRICT IN THE INTEGRATED MANAGEMENT OF GROUND AND SURFACE WATER,
Colorado State Univ., Fort Collins.
Stephen C. Smith.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 341-352, 1964. ref.

Descriptors: *Water districts, *Groundwater, *Surface water, *Water rights, *Water conservation, *Economics, *Regional planning, River basin, Compaction, Reservoirs, Overdraft, Wells, Floods, Recreation, Dams, Percolation, Irrigation, Compensation, Recharge, Discharge.
Identifiers: *Public districts, *Nonappropriation states, *Cyclic fluctuations, *Interregional transport, Storm-water drainage.

In this article, the public district is discussed as a public agency which is used in organizing integrated management of ground and surface water. Through the organizational process, integration can be achieved among both internal and external interests if the district has the legal, political and economic responsibility to perform this function. The public district is therefore an agency for collective action. This agency can function both where there is no state statutory administration of water rights and in appropriative states, especially in enacting programs such as combating physical uncertainties due to cyclic fluctuations, salt-water intrusion or compaction. Some management practices of the district may affect the legal status of water rights. The district can act to settle conflicts of interest internally by integrating the management of ground and surface water. The district can serve to relate repayment of a current investment in water utilization facilities to economic benefits accruing to the area over time. Finally, the district can represent internal interests within the district on a common basis to external interests in water management. (Murphy-Rutgers)
W70-01343

ORGANIZATIONS AND WATER RIGHTS IN THE RURAL-URBAN TRANSFER OF WATER,
Colorado State Univ., Fort Collins.
Stephen C. Smith.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 353-367, 1964. 15 p, 40 ref.

Descriptors: *Water allocation, *Economics, *Water rights, *Prior appropriation, *Riparian rights, Water resource development, Water policy, Cost-benefit analysis, Decision making, Water districts, Government, Cities, Surface water, Irrigation, Economic efficiency, Wells, Groundwater.
Identifiers: *Rural/urban competition, *Institutional machinery, *Correlative rights, *Beneficial use.

This article deals with the role of institutions in water economics, a delineation of institutional machinery, a definition of water rights as related to economic change, and economic competition within and between organizations. The economics in water policy is chiefly concerned with the problem of allocating water between rural and urban uses. Since this problem involves water rights, it is closely bound to public policy in which laws and institutions are used to represent values in the decision-making process. The institutions involved in water transfer encompass public districts, municipalities, state government and federal government. These are all concerned with the water problems of appropriative rights, riparian rights, correlative rights, and beneficial use. In the rural-urban transfer of water use, the economics involved call for study of water rights as real property, urban expansion, and inter-agency/intra-agency conflicts. Large interregional transfer agencies have become the predominant organizations in dealing with these difficulties, and the internal policies of such organizations have become more important in the problems than they were before, reflecting the dynamic character of the economy. (Murphy-Rutgers)
W70-01348

THE ABATEMENT OF POLLUTION.
Council of Economic Advisors, Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-01349

WATER RESOURCES: COMMENTS UPON THE FEDERAL-STATE RELATIONSHIP,
California Univ., Berkeley.
Sho Sato.
Economics and Public Policy in Water Resource Development, edited by S C Smith, and E N Castle, Ames, Iowa State University Press, p 317-337, 1964. 21 p, 111 ref.

Descriptors: *Economics, *Water rights, *Water law, *Riparian lands, *Flow control, *Federal reservations, Reclamation, River basins, Dams, Rivers, Water use, Tributaries, Water resources, Streams, Streamflow.
Identifiers: *Pelton dam, *Navigation servitude, Laissez-faire.

This article reviews and explores briefly two Congressional powers which have served as the basis for Congressional jurisdiction over water resources. These are the power to regulate interstate commerce and the power to regulate and dispose of the property of the United States. Until now, the power granted under the commerce clause has only related to navigation. A corollary, however, introduces the issue of whether or not the plenary power of Congress over navigable streams permits interference and even destruction of existing water uses with respect to watercourses within that power without compensation. As far as the property clause is concerned, a fog enshrouds congressional disruptive power over streams, rivers, and tidewaters within the realm of public domain. Several pieces of new legislation have been proposed to end these difficulties, although a potent argument exists to avoid complete state control of these issues in favor of the economic and available through the Federal government. Recent Supreme Court decisions have held that the United States has proprietary interest in any waters in which rights are unrecognized and Congress can repeal State statutes granting such rights to reserve the water for federal control or disposition. (Murphy-Rutgers)
W70-01351

THE ROLE OF GOVERNMENT IN A FREE SOCIETY,
Chicago Univ., Ill.
Milton Friedman.
Controlling Pollution: The Economics of a Cleaner America, edited by M. I. Goldman, Englewood Cliffs, Prentice-Hall, p 73-81, 1967. 9 p.

Descriptors: *Government, *Economics, *Technology, Public lands, Monopoly, Resource allocation, Land, Railroads, Political aspects, Value, Prices, Legal aspects, Riparian rights.
Identifiers: *Freedom, *Neighborhood effects, *Free society, Unanimity, Market, Patents.

This article deals with the role of government and stresses that the use of political channels rarely involves a question on which the public holds a unanimous feeling. Unanimity is stressed as an ideal. Due to the fact that this ideal is not present in our society, the author suggests that the government plays a role of umpire in resolving conflicts among the freedoms of different individuals. Several freedoms are cited, including freedom to combine, freedom to compete, property rights, and the monetary system. In our free society, the organization of economic activity through voluntary exchange is supervised through governmental maintenance of law and order. In other words, government serves to determine, arbitrate and enforce the rules of the market. This article has relevance to water resource policy makers in delineating the author's view of the proper extent of government's intervention in the market economy. (Murphy-Rutgers)
W70-01355

POLITICS AND ORGANIZATION IN WATER RESOURCE ADMINISTRATION: A COMPARATIVE STUDY OF DECISIONS,
Syracuse Univ., N.Y.
Frank Munger, and Anne Houghton.
Water Resources Research, Vol 1, No 3, p 337-347, Third Quarter 1965. 11 p, 1 tab, 34 ref.

Descriptors: *Water resources, Decision making, Political aspects, Reservoirs, Water supply, Flood control, Benefits, Natural resources, Resource development, Surface waters, Administrative agencies, Flow.
Identifiers: *Politics, *Water resources administration, Organizational arrangements, Governmental control, Decisions, Public agency, Private agency.

This paper represents an attempt to suggest one procedure by which a number of decisions concerning resource development can be brought together and interpreted in such a way as to support generalizations about resource policy making. The area of concern is limited to water resources and is focused specifically on a relationship between political pressures and the decision as to the kind of agency, public or private, that is to administer a specific project for the control of surface flows. The paper is restricted in two principal ways. First, it is confined to water resource decisions concerning the control of surface waters and excludes both projects involving the development of groundwater and the very substantial investment in the treatment of wastes. Secondly, it focuses upon only one aspect of such decisions, the designation of the

administrative agency or enterprise that will assume the responsibility for the operation of control reservoirs. (Loeb-Rutgers)
W70-01358

MANAGING WATER QUALITY: ECONOMICS, TECHNOLOGY, INSTITUTIONS,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-01361

NATIONAL WATER RESOURCES ADMINISTRATION,
Yale Univ., New Haven, Conn.
For primary bibliographic entry see Field 06B.
W70-01379

CHEMICAL POLLUTION OF THE SEA AND THE LAW (FRENCH),
Montpellier Univ. (France). Faculte de Droit.
For primary bibliographic entry see Field 05G.
W70-01473

MINING AND WATER CONSERVATION.
For primary bibliographic entry see Field 03E.
W70-01570

RIVER BEDS.

Pa Stat Ann Tit 64, secs 262-265 (1959).

Descriptors: *Pennsylvania, *River beds, *Minerology, *Ownership of beds, Legislation, Legal aspects, Beds, Navigable rivers, Low water mark, Mining, Iron, Coals, Limestones, Gravels, Sands, Navigation, Dams, Canals, Banks, Riparian rights, Administrative agencies, Surveys.
Identifiers: Warrants of state lands.

When application is made to the Secretary of Internal Affairs for a warrant of state land, he directs the appropriate county surveyor to survey so much of the bed of any public navigable river as is called for in the application. Specific procedures for the survey are provided. The right to dig and mine minerals vests in the warrant grantee provided: the right is not exercised so as to interfere with navigation or the rights of persons holding property on the banks of the river; and, the right is not exercised so as to undermine the bed of any river within one hundred yards of any dam, lock, or other structure erected to improve navigation. Any person holding a warrant may, within ten years after its issuance, receive a patent for the land described therein upon payment of the usual price per acre for public lands. No part of this act will be construed to grant any right to the surface of the bed of any river; but any rights acquired hereunder are confined to sinking shafts and mining beneath the beds of such rivers. (Keith-Florida)
W70-01574

CONSERVANCY.
For primary bibliographic entry see Field 04A.
W70-01585

CONSERVANCY.
For primary bibliographic entry see Field 04A.
W70-01586

CONSERVANCY.
For primary bibliographic entry see Field 04A.
W70-01587

CONSERVANCY.
For primary bibliographic entry see Field 04A.
W70-01588

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-01589

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-01590

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-01591

WATERS: SURFACE WATER DRAINAGE,
For primary bibliographic entry see Field 04A.
W70-01592

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
For primary bibliographic entry see Field 06D.
W70-01593

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
For primary bibliographic entry see Field 06D.
W70-01594

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
For primary bibliographic entry see Field 06D.
W70-01595

THE IMPACT OF THE COMMERCE CLAUSE ON THE RIPARIAN RIGHTS DOCTRINE,
For primary bibliographic entry see Field 06D.
W70-01596

LEGISLATIVE RESTRICTIONS.

Miss Const Art 4, secs 81, 90 (g).

Descriptors: *Mississippi, *Navigable waters, *Bridges, Legislation, Public lands, Railroads, Construction, Chutes, Fish, Fishing, Eminent domain, Watercourses, Lumbering, State governments, Transportation, Safety, Barriers, Navigation.
Identifiers: *Obstructions to navigation.

The legislature shall never authorize the permanent obstruction of any of the navigable waters of the state. The legislature may provide for the removal of any existing obstructions whenever the public welfare demands. This section shall not prevent the construction, under proper authority, of drawbridges for railroads or other roads, or the construction of booms and chutes for logs when the safe passage of vessels is not prohibited. The legislature shall not pass local, private, or special laws: (1) granting the right to have any ferry, bridge, road, or fish-trap; (2) relating to stock laws, water-courses, and fences; (3) conferring the power to exercise the right of eminent domain; and (4) granting any lands under control of the state to any person or corporation. Such matters shall be provided for only by general laws. (Schram-Florida)
W70-01597

BRIDGES AND TUNNELS ACROSS TRIBUTARIES OF THE GULF OF MEXICO AND MISSISSIPPI SOUND.

Miss Code Ann secs 8447-01 thru 8447-36 (1956).

Descriptors: *Mississippi, *Bridges, *Highways, *Bridge construction, Gulf of Mexico, Eminent domain, Costs, Construction, Road construction, Engineering structures, Tunnel construction, Construction costs, Cost allocation, Legislation, Legal aspects, State governments, Federal government, Financing, Project planning, Administrative agencies, Assessments, Benefits.

The state highway commission is authorized to construct and maintain bridges, tunnels, or causeways across any tidewater, bay, or river tributary of the Gulf of Mexico or Mississippi Sound. The cost of these projects may be financed by bonds. The commission may accept funds from the federal government and may exercise eminent domain to acquire bridge sites. Each project shall be regarded as part of the state highway system. A bridge district, for the purpose of constructing and operating an interstate bridge, may be established. A commission may then be appointed by the county court to plan construction of the bridge and to assess costs on the basis of benefit to landowners, both public and private. The commissioners may collect tolls for transit over the bridge. The commissioners are empowered to negotiate contracts with the federal or state governments and to acquire real estate by eminent domain. (Kelly-Florida)
W70-01598

BRIDGE REVENUE BOND ACT.
For primary bibliographic entry see Field 06C.
W70-01599

NUMBERING OF UNDOCUMENTED VESSELS.
Miss Code Ann sec 8496-03 (Supp 1968).

Descriptors: *Mississippi, *Ships, *Boats, *Boating regulations, Legislation, State governments, Federal government, Regulation, Permits, Navigable waters, Boating, State jurisdiction, Federal jurisdiction, Oceans, Foreign countries.
Identifiers: Boat registration.

Every undocumented vessel propelled by machinery in excess of ten horsepower, whether or not such machinery is the principal source of propulsion, using the territorial and navigable waters of the state must be properly numbered. In addition, every such vessel owned in this state and using the high seas must likewise be numbered. Certain specified types of vessels are excluded from this requirement. (Schram-Florida)
W70-01600

SEA WALLS AND HIGHWAY PROTECTION.
For primary bibliographic entry see Field 04A.
W70-01601

SOIL AND WATER CONSERVATION.
For primary bibliographic entry see Field 04D.
W70-01602

GAME AND FISH.

Miss Code Ann secs 5844, 5844-01, 5844-11, 5856, 5857, 5862, 5862.5, 5863, 5866, 5870, 5872.7, 5883.5, 5900, 5902, 5902, 5902.5, 5903, 5905, 5906, 5911.5, 5912, (1952), as amended, (Supp 1968).

Descriptors: *Mississippi, *Wildlife management, *Freshwater fish, *Fish management, Legislation, Administrative agencies, Wildlife conservation, Sport fish, Commercial fishing, Fishing, Fish stocking, Recreation, Permits, Fish farming, Bait fishing, Fishing gear, Legal aspects, Regulation.
Identifiers: *Licensing.

Powers of the Game and Fish Commission are outlined, which generally provide for the protection, distribution and regulation of wild game and fish. Duties and powers of wardens and other peace officers are established, and fines and penalties for violations of fish and game laws are prescribed. Provisions are made for fees and licenses for resident and non-resident sport fishermen, commercial fishermen, wholesale dealers, and minnow dealers. Alligators are protected, and frogs and turtles may be taken for commercial use only by license or special permit. Lawful methods of taking fish are prescribed, and certain methods are expressly prohibited. Reciprocal licensing and regula-

tions are authorized with Arkansas and Louisiana for adjoining waterbodies. (Douberley-Florida)
W70-01603

GAME AND FISH.

Miss Code Ann secs 5844, 5844-01, 5844-11, 5856, 5857, 5862, 5862.5, 5863, 5866 (1952), as amended, (Supp 1968).

Descriptors: *Sport fish, *Fishing, *Fish management, *Recreation, Fish, Regulation, Freshwater fish, Fish conservation, Wildlife conservation, Fish stocking, Fisheries, Administrative agencies, Permits, Flooding, Fishkill, Non-consumptive use, Wildlife management.
Identifiers: Penalties.

The Game and Fish Commission is authorized to make rules and regulations, to inaugurate surveys, and to establish services as necessary. It is empowered to vary prescribed fishing seasons if necessary for the preservation of a species, to designate protected areas, to acquire land for sport and recreation, to stock or restock lands or waters, to have exclusive control over the propagation and distribution of wild game and fish, to regulate the taking of non-game gross fish, and to issue fishing permits. The Commission may acquire lands inundated by waters behind a structure built to prevent the drying up of a natural waterbody. Duties and powers are provided for the Director of Conservation, the game and fish wardens and other peace officers. Funds collected by the Commission are used by it, except that a portion of fines collected goes to the county with jurisdiction over the violation. Fines and penalties for violations of laws and regulations are prescribed. (Douberley-Florida)
W70-01604

GAME AND FISH.

Miss Code Ann secs 5870, 5872.7, 5883.5, 5900, 5902, 5902.5, 5903, 5905, 5906, 5911.5, 5912 (1952), as amended, (Supp 1968).

Descriptors: *Commercial fish, *Sport fish, *Permits, *Fishing, Fish farming, Reservoir fishing, Nets, Minnows, Commercial fishing, Bait fishing, Fishing gear, Freshwater fish, Frogs, Turtles, Regulation, Fish conservation, Fish control agents.
Identifiers: Fishing permits, Alligators, Interstate cooperation.

Resident licenses are issued to citizens who have been residents in the state for six months. Wholesale minnow dealers are licensed by the Game and Fish Commission, and fees are set out for resident and non-resident dealer licenses. Frogs or turtles may not be taken for commercial use without a resident license or a special permit. It is unlawful to hunt, kill or catch alligators. Lawful means of taking game fish are specified, and the use of chemicals, explosives or electricity to take any fish is prohibited. Game fish taken by nets or seins must be immediately returned to the water. Taking of non-game gross fish in certain reservoirs and rivers may be regulated by the Commission. Game fish may not be sold unless grown in a private pond, and fish dealers may not possess game fish. Fees and regulations are provided for commercial, resident and non-resident fishing and wholesale dealer licenses. The Commission may negotiate with Arkansas and Louisiana to effectuate reciprocal regulations and licensing with relation to the Mississippi River area and the Pearl River. (Douberley-Florida)
W70-01605

SCHROEDER V ZIEGELMAN (RIGHT TO USE OF CANAL ON ANOTHER'S PROPERTY).
For primary bibliographic entry see Field 04A.
W70-01606

SEIFERT V SOUND BEACH PROPERTY OWNERS ASS'N (WATER DAMAGE FROM IMPROVEMENTS ON ADJACENT PROPERTY).
For primary bibliographic entry see Field 04C.
W70-01607

INCORPORATION OF SANITATION DISTRICTS.
For primary bibliographic entry see Field 05G.
W70-01608

SURVEY OF OPERATING EXPERIENCES UNDER NEW STATE WATER LAWS,
For primary bibliographic entry see Field 06B.
W70-01609

POWERS OF COMMISSION OF GAME AND INLAND FISHERIES.

Va Code Ann secs 29.11 thru 29.13 (1969).

Descriptors: *Virginia, *Administrative agencies, *Wildlife management, *Wildlife conservation, Fishing, Hunting, Regulation, Forest management, Preservation, Conservation, Fisheries, Federal government, Impounded waters, Lakes, Dams, Construction, Supervisory control (Power), Fish.
Identifiers: Fish and game preserves, Fish and game refuges.

The Commission of Game and Inland Fisheries has the power to: (1) acquire land and waters in the state for Commission purposes; (2) construct buildings, dams, lakes, and ponds necessary for game and fish preservation operations; (3) replenish and restock lands and inland waters; (4) establish fish and game refuges and preserves as well as regulations for same; (5) carry on conservation education programs; and (6) enforce all game and fish laws and regulations. The Commission controls hunting and fishing rights on all impounded water areas resulting from power development. It also controls forest areas owned by the federal government, subject to the rights of the Department of Agriculture. (McDonough-Florida)
W70-01610

REGULATIONS REGARDING CLAMS AND SCALLOPS.

Va Code Ann secs 28.1-160 thru 28.1-163 (1969).

Descriptors: *Virginia, *Fish management, *Shellfish, *Commercial shellfish, Clams, Commercial fishing, Permits, Fish conservation, Legislation, Legal aspects, Oysters, Administrative agencies, State jurisdiction, Water pollution, Taxes.
Identifiers: Scallops.

Every person engaged in the business of buying, marketing, and shipping scallops, clams, and bivalves, other than oysters from within the state, must pay an annual license tax. If anyone is found in possession of oysters while engaged in taking clams or scallops during the season in which taking oysters from natural rocks, beds, or shoals is prohibited, he is presumed guilty of violating the statute regulating oyster fishing. The Commissioner of Fisheries is authorized to dredge clams in polluted areas for the purpose of replanting in public clamming grounds. The commissioner may be his own authority or upon petition set aside any ground in the state's waters, not previously assigned for planting or bathing purposes, as a public clamming or scalloping grounds. A season for catching scallops, as well as a minimum size requirement, is established by the statute. (Kelly-Florida)
W70-01611

THE NAVIGATION SERVITUDE,
For primary bibliographic entry see Field 04A.
W70-01612

WHARVES, DOCKS, PIERS AND BULKHEADS.

Va Code Ann secs 62.1-164, 62.1-165.

Descriptors: *Virginia, *Docks, *Piers, *Bulkheads, Legislation, Coastal structures, Construction, Permits, Local governments, Navigation, Watercourses, Engineering structures, Judicial decisions, Administration, Decision making, Water policy, Regulation, Cities.
Identifiers: Obstruction to navigation.

Any person owning land upon a watercourse may erect a wharf, pier, or bulkhead on said watercourse; provided, navigation is not obstructed, nor the private rights of any person be otherwise injured thereby. The circuit court of the country in which such structure is located may abate the same if navigation is obstructed or any private landing is encroached upon. Any person desiring the privilege of erecting a wharf at or on any county landing may, after giving notice of his intention, present to the circuit court of the county a petition for such privilege. The court may determine the same and may, in its discretion, grant such privilege and fix such rates and charges upon such conditions and limitations as to it may seem fit. The court, at any subsequent term, may revoke such privilege, alter such conditions or limitations, or regulate the rates and charges. This section is not intended to authorize a circuit court to grant the privilege of erecting a wharf within a city. (Schram-Florida)
W70-01613

MOTORBOATS AND WATER SAFETY.

Va Code Ann secs 62.1-166 thru 62.1-169, 62.1-171, 62.1-173, 62.1-179, 62.1-180, 62.1-182, 62.1-184, 62.1-185 (1968).

Descriptors: *Virginia, *Boating, *Water sports, *Safety, Recreation, Public health, Boating regulations, Swimming, Water skiing, Administrative agencies, Local governments, Coast guard regulations, Legislation, Surf-boarding, Permits, Recreation facilities, Boats, State governments, Social aspects.

The declared policy of the state is to promote safety for persons and property in and connected with the use, operation, and equipment of vessels. The Commission of Game and Inland Fisheries shall enforce and administer the provisions of this chapter. All expenses required for administration and enforcement of this chapter shall be paid from the funds collected pursuant to this chapter. Every motorboat on the waters of the state must bear identification numbers. Any person owning land bordering on any waters of the state may petition the Commission to authorize the placing of markers around a public swimming area at the expense of the petitioner. A motorboat need not be numbered if it is either federally registered, a foreign vessel, lifeboat, racing boat, or under ten horsepower. Waterskiing is regulated. Skiing in public swimming areas is prohibited. Any local government may, if permitted by the Commission, make additional regulations. Provisions for the enforcement and punishment of violations of the chapter are included. (Schram-Florida)
W70-01614

PROTECTION OF AIDS TO NAVIGATION.
Va Code Ann secs 62.1-187 thru 62.1-189 (1968).

Descriptors: *Virginia, *Buoys, *Warning systems, *Navigation, Legislation, Ships, Anchors, Boats, Naval architecture, Lighthouses, Harbors, Boating, Safety, Boating regulations, Adjudication procedure, State governments, Accidents, Damages, Fouling, Admiralty, Transportation.
Identifiers: Navigation aids.

It is a misdemeanor for any person to: (1) moor any vessel to any buoy, beacon, or day mark; (2) willfully remove, damage, or destroy any such naviga-

tional aid; (3) cut down, remove, or damage any beacon erected on land; or (4) through unavoidable accident run down, drag from its position, or in any way injure any buoy, beacon, or day mark and fail to give notice as soon as practicable to the harbor master, other legal manager of the port, or to the United States Coast Guard. Upon conviction of such violations, the offender shall be fined not more than two hundred dollars or imprisioned not more than three months or both. The cost of repairing or replacing any such buoy, beacon, or day mark, when the cause of same has been legally ascertained, shall be a lien upon the vessel causing the damage. It is a misdemeanor punishable by not more than fifty dollars to anchor any vessel on the range of any range light unless such anchorage is unavoidable. (Schram-Florida)
W70-01615

COMPACT AND BOUNDARY BETWEEN VIRGINIA AND MARYLAND.

Va Code Ann sec 7.1-7 (1966).

Descriptors: *Virginia, *Maryland, *Boundaries (Property), *State jurisdiction, Legislation, Boundary disputes, Legal aspects, Political aspects, Navigation, State governments, Interstate compacts, Interstate rivers, Fish conservation, Water conservation, Channel improvement, Riparian rights, Public benefit.

The 1785 compact between Virginia and Maryland remains obligatory except so far as it may have been superseded by the provisions of the United States Constitution. The compact provides that citizens of each state shall have full property rights in the shores of the Potomac adjoining their lands. Fishing rights are to be common and equal to citizens of both states. Mutual statutes shall be made for the preservation of fish, preserving the channel, and maintaining navigation in the Potomac. Jurisdiction for piracies, crimes, and offenses committed in the waters dividing the states is discussed in detail. The boundary line between Virginia and Maryland, established in 1878, is described in detail. This also is declared to be still in effect and binding upon the states and the citizens thereof. Numerous provisions for mutual jurisdiction, the reach of process into the adjoining state, and property disputes are outlined. (Schram-Florida)
W70-01616

CROSSINGS AND CONNECTIONS.
Va Code Ann secs 56-16, 56-17, 56-32, 56-34 (1969).

Descriptors: *Virginia, *Canals, *Roads, *Utilities, Industries, Canal construction, Highways, Streams, Administrative agencies, Administration, Judicial decisions, Industrial water, Local governments, Governments, Legislation, Public utilities, Obstruction to flow.

Every public service corporation whose canal passes through any person's land shall provide a suitable wagonway across such canal upon written request of the landowner. Failure to provide a wagonway within ten days after request, enables the landowner to apply to the circuit court of the county to have a board of commissioners appointed to decide if a wagonway should be constructed. The company shall be fined five dollars per day for failure to provide such wagonway as ordered. A public service corporation may cross the canal of another such corporation. However, such crossing shall in no way impair operations of the canal to be crossed. No state highway, county road, stream, or watercourse shall be altered, closed, or obstructed by any public service corporation without the approval of the State Highway Commissioner and any other governing body involved. Such corporation shall provide a highway or waterway in lieu of the one so altered or closed. The General Assembly reserves the right to connect any company's canal with any other company's canal. (Smith-Florida)
W70-01617

HARBORS AND HARBOR LINES.
RI Gen Laws Ann secs 46-4-1 thru 46-4-8 (1956), as amended, (Supp 1968).

Descriptors: *Rhode Island, *Harbors, *Tidal waters, *Local governments, Coastal engineering, Navigation, Coasts, Planning, Regulation, Port authorities, Boats, Ships, State jurisdiction, Transportation, Legislation, Legal aspects, Administrative agencies, Administration.
Identifiers: Harbor lines.

After holding prescribed public hearings, the Director of Public Works may mark out and plot harbor lines to be established in any of the state's public tidewaters. The recommended harbor lines must be approved by the governor and senate before they become effective. The council of any municipality is authorized to appoint a harbor master for harbors within its jurisdiction. The city of Providence is given an expanded jurisdiction for purposes of this statute. Specific towns are authorized to regulate speed, management, and control of all vessels within their respective boundaries by ordinance. These towns may also regulate the size, type, location, and use of all anchorages and moorings within their respective harbors. None of the powers granted to municipalities by the statute are deemed to supercede the authority of the state Director of Public Works over the public tidewaters of the state. (Kelly-Florida)
W70-01618

DEVELOPMENT, CONSERVATION AND USE OF WATER RESOURCES.
For primary bibliographic entry see Field 06B.
W70-01619

FOREST GAME FISH AND RECREATION RESERVES.

Va Code Ann secs 10-22 thru 10-26, 10-31 (1964).

Descriptors: *Virginia, *Forest management, *Administration, *Wildlife management, Forests, Land use, Lumbering, Recreation, Hunting, Fishing, Land development, Land management, Permits, Income, Operating costs, Taxes, Administrative agencies, Governments, Legislation.

The owner of any forest or timber land may offer the same, subject to pasturage, to the Department of Conservation and Development as a forest, game, and recreation reserve. If such land is accepted by the State Forester, the owner shall deliver a written lease to the Director, leasing the land and all hunting, fishing, and recreational rights to Virginia until the timber thereon shall become suitable for marketing as lumber. The State Forester shall aid in the development and protection of such lands. The Commission of Game and Inland Fisheries is authorized to sell hunting, fishing, and limited recreational privileges on any reserve so created. All funds accrued from the sale of privileges on such reserves shall be paid into a state fund to be used for the administration, protection, development, and taxation of the reserve lands. No tax or local levy shall be paid unless the owner desires to do so. Such taxes shall be deferred until such time as the timber on the reserve is marketed. The Director and the Commission are authorized to promulgate and enforce rules and regulations governing the reserve. (Smith-Florida)
W70-01620

LOCAL FLOOD PREVENTION AND WATER SUPPLY.
For primary bibliographic entry see Field 04A.
W70-01621

PUBLIC UTILITIES AND POLLUTION PREVENTION.
For primary bibliographic entry see Field 05G.
W70-01622

ZONING.
For primary bibliographic entry see Field 06F.
W70-01623

WATER POLLUTION CONTROL BY MUNICIPALITIES.
For primary bibliographic entry see Field 05G.
W70-01624

FEDERAL ROLE IN POLLUTION CONTROL,
For primary bibliographic entry see Field 05G.
W70-01625

PERMANENT JOINT COMMITTEE ON WATER RESOURCES.
For primary bibliographic entry see Field 06B.
W70-01626

WATER AND WATER COURSES - LAND-LOCKED NON-NAVIGABLE LAKES - OWNERS RESTRICTED TO REASONABLE USE.
For primary bibliographic entry see Field 06D.
W70-01627

DAMAGES FROM MILLDAMS.
For primary bibliographic entry see Field 04A.
W70-01628

INSPECTION OF DAMS AND RESERVOIRS.
For primary bibliographic entry see Field 04A.
W70-01629

INTERTIDAL SALT MARSHES.
For primary bibliographic entry see Field 06G.
W70-01630

THE TAKING OF QUAHAUGS AND CLAMS.
R I Gen Laws Ann secs 20-11-1 thru 20-11-5, 20-11-7 thru 20-11-13 (1968).

Descriptors: *Rhode Island, *Shellfish, *Commercial shellfish, *Clams, Permits, Regulation, Boats, Administrative agencies, Commercial fish, Legislation, Legal aspects, State governments, Fish harvest, Fish management, Wildlife management, Fish conservation, Fishing gear, Commercial fishing.
Identifiers: Quahaugs.

The taking or possession of quahaugs under the minimum size is unlawful. No person may, unless duly licensed, take quahaugs or clams by dredges, rakes, or other apparatus operated by mechanical power or hauled by boat. Licenses for the dredging of quahaugs may be obtained from the Director of Natural Resources in accordance with the procedures herein provided. Boats used in quahaug dredging must be registered. This act establishes a maximum daily take on quahaugs and also provides for: (1) the opening of areas for dredging; (2) areas permanently closed; (3) the unlawfulness of carrying power apparatus during closed season; (4) the disciplinary suspension of boat registration; (5) suspension of dredging licenses; (6) penalties for violation of this act including the impoundment of boats; and (7) the assessment of the costs of seizure and impoundments of boats. (Marsee-Florida)
W70-01631

SEINES, NETS AND WEIRS.

R I Gen Laws Ann secs 20-19-1 thru 20-19-28 (1968).

Descriptors: *Rhode Island, *Fish management, *Interstate compacts, *Administration, Regulation, Nets, Weirs, Dams, Gill nets, Trapping, Rivers, Ponds, Channels, Islands, Connecticut, Management, Fish, Fish conservation, Wildlife management, Fishing, Water sports, Administrative agencies, Governments.

Regulations regarding the use of seines, nets, or other contrivances are established for specifically named bodies of water. A compact with Connecticut governing fishing in the Pawcatuck River is established. Any owner of land adjoining the Pawcatuck River who allows certain named violations of said compact to occur on his land is liable as though he had committed such violations. The Department of Natural Resources has general supervisory and regulatory powers in all matters relating to this chapter. The Director of the Department may co-operate with agencies of other states and makes an annual report to the general assembly. (Smith-Florida)
W70-01632

FRESH WATER FISHING.
R I Gen Laws Ann secs 20-21-1 thru 20-21-21 (1968).

Descriptors: *Rhode Island, *Fish management, *Fish conservation, *Regulation, Control, Fishing, Fish, Fish harvest, Wildlife conservation, Spawning, Fish reproduction, Permits, Administration, Administrative agencies, Trout, Bass, Rivers, Ponds, Streams, Legislation, Bait fishing, Ice fishing, Equipment, Commercial fishing, Sport fishing, Nets, Fisheries, Fishing gear, Fish stocking.

With certain exceptions, closed seasons, maximum daily catches, and a minimum size are established for game fish. The purchase and sale of certain varieties of fish is prohibited. Unless privately owned, no stream or pond may be stocked without approval of the Department of Natural Resources. Placing any substance injurious to fish in any stream or pond is prohibited, except as otherwise provided by law. Methods of catching fish and equipment used therefore are regulated. (Smith-Florida)
W70-01633

MINNOWS; RECIPROCAL ENFORCEMENT OF FISHING LAWS.
R I Gen Laws Ann secs 20-22-1 thru 20-22-8, 20-23-1 (1968).

Descriptors: *Rhode Island, *Minnows, *Fish management, *Interstate compacts, Interstate rivers, Control, Animal control, Fishing, Nets, Weirs, Management, Permits, Fish, Wildlife conservation, Spawning, Fish reproduction, Administration, Administrative agencies, Regulation, Baits, Bait fishing, Legislation, Bait traps, Supervisory control (Power), Fish conservation, Water resources development.

A license is required to engage in the minnow business or to possess more than one hundred live freshwater minnows at one time. Lawful methods for taking freshwater minnows are set out. The Director of Natural Resources is authorized to make additional regulations concerning the methods, times, numbers, and seasons for taking freshwater minnows. There is provision for interstate cooperation in the enforcement of fishing laws. (Smith-Florida)
W70-01634

CONDEMNATION FOR WATER SUPPLY PURPOSES.
R I Gen Laws Ann sec 39-15-1 (1956).

Descriptors: *Rhode Island, *Condemnation, *Water supply, *Local governments, Dams, Water, Water demand, Water requirements, Water works, Water resources, Water resources development, Eminent domain, Right-of-way, Legislation, Contracts, Supply contracts, Reservoirs, Pumping, Pumping plants, Highways, Highway relocation, Bridges, Bridge construction.

Whenever the electors of any town have voted to provide a water supply for the inhabitants of such town, or whenever any town has made contracts for such a water supply, then such town, or the party bound to fulfill such contract, may take, condemn, hold, use, and permanently appropriate any land, water, rights of water and of way, necessary for furnishing or enlarging any such water supply, including sites and materials for dams, reservoirs, pumping stations, and coal houses, with right-of-way across public or private lands, including lands to be covered by water. The grade of any highway may be altered and bridges therein built for the accomodation of such water supply. (Smith-Florida)
W70-01635

WATER FENCES.
R I Gen Laws Ann secs 34-10-6 thru 34-10-8 (1956).

Descriptors: *Rhode Island, *Barriers, *Marshes, *Animal control, Limiting factors, Tidal marshes, Ocean water, Cattle, Sheep, Domestic animals, Riparian rights, Riparian land, Control, Regulation, Land use, Legislation, Legal aspects.
Identifiers: Water fences, Trespass.

Coterminous owners or possessors of land adjoining water, whenever their land is under improvement, shall maintain a sufficient water fence to prevent trespass by cattle in the same manner as other partition fences are directed by this chapter. All tracts of marshland so exposed to the sea as to render partition fences impracticable are exempt from this chapter. The owner of any marshland so exempted has the remedies for trespass provided in other cases if any person permits his cattle, sheep, horses, or hogs to run upon such marshland. (Smith-Florida)
W70-01636

SOVEREIGNTY AND STATE JURISDICTION; COUNTY JURISDICTION.

R I Gen Laws Ann secs 42-1-1, 42-1-3, 42-3-6 (1956).

Descriptors: *Rhode Island, *State jurisdiction, *Boundaries (Property), *High water mark, Jurisdiction, Federal jurisdiction, Legal aspects, Governments, Legislation, Shores, Coasts, National seashores, Boundaries (Surfaces), Local governments, Bays, Waters, Rivers, Streams.
Identifiers: Headlands.

The territorial limits of this state extend one marine league from its seashore at high water mark. When an inlet does not exceed two leagues between its headlands, a straight line from one headland to the other is equivalent to the shore line. Certain tracts are ceded to the United States, some of which border on waters of the state. With enumerated exceptions, jurisdiction of counties separated by or bordering on public waters is concurrent over such waters. (Smith-Forida)
W70-01637

THE RHODE ISLAND DEVELOPMENT COUNCIL.
For primary bibliographic entry see Field 06B.
W70-01638

MAINTENANCE OF TOWN HIGHWAYS.
For primary bibliographic entry see Field 04C.
W70-01639

HIGHWAYS: DRAINAGE OF SURFACE WATER.
For primary bibliographic entry see Field 04A.
W70-01640

POWERS OF THE TURNPIKE AND BRIDGE AUTHORITY.

R I Gen Laws Ann sec 24-12-9-s (1956).

Descriptors: *Rhode Island, *Administrative agencies, *Right-of-way, *Data collections, Surveys, Sounding, Drilling, Civil engineering, Inspection, On-site data collections, Terrain analysis, Condemnation, Eminent domain, Highways, Bridges, Administration, Governments, Legislation.

The Turnpike and Bridge Authority may enter upon any lands, waters and premises to make such surveys, soundings, borings and examinations as the Authority may deem necessary or convenient for its purposes. Such entry shall not be deemed a trespass nor shall such entry be deemed an entry under any condemnation proceedings. The Authority must pay for any actual damages resulting from such an entry. (Smith-Florida)
W70-01641

6F. Nonstructural Alternatives

CAN ECOLOGY PROVIDE THE BASIS FOR SYNTHESIS,
Wisconsin Univ., Madison. Lab. of Limnology.
Arthur Hasler.
Social Sciences and the Environment, Colorado University Press, 1967. p 42-45.

Descriptors: *Ecology, *Environment, *Synthesis, *Environmental effects, Eutrophication, Limnology, Reservoirs, Water pollution effects, Planning, Water pollution control.
Identifiers: Social science, Physical science, Resource management, Evolution, Water resources management, Weather modification, Species extinction, Blue whale, Religious influence, Italy, Madison (Wis), Lake Washington (Wash), Lake Tahoe (Calif-Nev), Lake Zurich (Switz), Lake Baikal (USSR), Lake Wingra (Wis), Lake Mendota (Wis), Lake Monona (Wis), Lake Kegonsa (Wis), Lake Waubesa (Wis).

Throughout history man has modified his environment. Today he faces the price of some of these modifications; extinction of animal species (blue whale and others), deterioration of water quality, flood damage resulting from poor agricultural practices, to mention only a few. More research is needed to solve some of the national and international problems regarding man-made environments, but in many aspects sufficient technology is available to reverse such effects if we had the economic capacity and laws to initiate action. Author feels that, where scientists and mass communications media are lacking, there exists a role for the church, through personal contact, in influencing people to re-evaluate adverse effects of outdated techniques of land management. There is a great lack of communication between scientific disciplines which could prevent future mistakes by presenting viable alternatives to present techniques. Although man-induced changes in the environment will necessarily occur, ecologists have knowledge and techniques which can be used to diminish destructive and deteriorative processes, can suggest alternatives and can work cooperatively with other scientists to find better solutions. (Ketelle-Wisconsin)
W70-01582

ZONING.

Va Code Ann secs 15.1-486, 15.1-489, 15.1-490 (1964), as amended, (Supp 1968).

Descriptors: *Virginia, *Zoning, *Resource development, *Local governments, Water policy, Water resources development, Water resources, Administration, Cities, Conservation, Flood plain zoning, Governments, Natural resources, Planning, Resources, Water conservation, Flood plains, Flood protection, Flood control, Land use, Sewage, Regulation, Legislation.

The governing body of any county or municipality may divide its territory into districts, and each district may regulate, restrict, permit, prohibit, and determine the following: (1) the use of land, buildings, structures, and other premises for

agricultural, commercial, industrial, residential, flood plain, and other purposes; (2) the size, location, construction, or removal of structures; (3) the areas and dimensions of land, water, and air space to be occupied by structures and uses, and of open spaces to be left unoccupied, based on whether a public or community water supply or sewer system is available and used; and (4) the excavation of natural resources. Zoning ordinances shall be for the general purpose of promoting the public health, safety, or general welfare. To these ends such ordinances shall provide adequate safety from fire, flood, and other dangers, and shall expedite the provision of adequate water, sewage, flood protection, and other public requirements. Such districts shall be drawn with reasonable consideration for the conservation of natural resources, and preservation of flood plains. (Smith-Florida)
W70-01623

6G. Ecologic Impact of Water Development

INTERTIDAL SALT MARSHES.
R I Gen Laws Ann secs 11-46.1-1 (Supp 1967).

Descriptors: *Rhode Island, *Fishing, *Tidal marshes, *Balance of nature, Legislation, Legal aspects, Marshes, Coastal marshes, Salt marshes, Intertidal areas, Fish, Fish conservation, Shellfish, Nitrates, Phosphates, Plankton, Organic compounds, Permits, Natural resources, Regulation, Marsh plants, Administrative agencies, Ecology, Excavation, Water pollution, Pollution abatement.
Identifiers: *Intertidal salt marshes, Penalties (Criminal).

The state constitution guarantees the right to fish. This right cannot be enjoyed unless fish and shellfish can be found in abundance. The metabolism and katabolism of plants and animals found in salt marshes furnishes the nitrates, phosphates, sugars, plankton, and organic chemicals necessary for the nuture of fish and shellfish. The salt marshes of the state are in jeopardy of despoliation. To remedy the foregoing state of affairs it is resolved that any person who dumps or deposits mud, dirt, or rubbish on, or who excavates and disturbes the ecology of intertidal salt marshes without first obtaining a permit from the department of natural resources will be fined. For the purposes of this chapter, an intertidal salt marsh is described in terms of enumerated plants which grow thereon. The director of natural resources will refuse to issue a permit if in his judgement the end result would be the disruption of the ecology of a salt marsh. (Keith-Florida)
W70-01630

07. RESOURCES DATA

7A. Network Design

THE DEFINITION OF THE TERMS HYDROLOGICALLY ARID AND HUMID FOR AUSTRALIA,
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
J. R. Watkins.
J Hydrol, Vol 9, No 2, p 167-181, Oct 1969. 15 p, 9 fig, 5 tab, 7 ref.

Descriptors: *Rainfall-runoff relationships, *Arid lands, *Classification, *Climatic zones, Precipitation (Atmospheric), Runoff, Water yield, Temperature, Hydrology, Groundwater, Geomorphology, Evaporation.
Identifiers: *Australia, Aridity classification.

The importance of using runoff data as a measure of aridity is emphasized. If aridity is defined in terms of annual runoff, a direct relationship will then exist between the behavior of surface storages, groundwater hydrology and geomorphic landform process. Stream gage data and simple methods of estimation from either precipitation and evaporation or precipitation and temperature data are discussed for Australian stations. A classification into four main zones of varying hydrologic aridity is proposed. (Knapp-USGS)
W70-01267

RECORDER CHART PROCESSING OF HYDROMETEOROLOGICAL AND HYDROLOGIC DATA AT THE HYDROLOGICAL SECTION OF THE HYDROLOGY SECTION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM (FRENCH),
Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
F. Bultot, and G. L. Dupriez.
Brussels Institut Royal Meteorologique de Belgique, 1968. 32 p, 1 fig, 13 tab, 3 append.

Descriptors: *Instrumentation, *Hydrometry, *Hydrologic data, *Data processing, *Networks, Stations, Air temperature, Winds, Gages, Humidity, Water temperature, Precipitation (Atmospheric), Water level fluctuations, Discharge (Water), Evaporation.
Identifiers: *Belgian Royal Meteorological Institute.

This monograph describes a method of recording and processing hydrometeorological and hydrological data used by the Royal Meteorological Institute of Belgium. The discussion includes: gaging station net; data processing (temperature, humidity, precipitation, water level); data storage; data utilization; semiautomatic reader for scanning conventional climatological maps; tables of air temperature, humidity, pressure, precipitation, and water discharge; and the tables of hydrometeorological data, depth of runoff, and the distribution of hourly, monthly, and annual precipitation. (Gabriel-USGS)
W70-01284

DRAINAGE NETWORK ANALYSIS WITH K-BAND RADAR IMAGERY,
Kentucky Univ., Lexington. Dept. of Geography.
Roger M. McCoy.
Geogr Rev, Vol 59, No 4, p 493-512, Oct 1969. 20 p, 11 fig, 3 tab, 10 ref. NASA Contract No 17-0004-003 and NASA Grant NsG-298.

Descriptors: *Drainage, *Drainage systems, *Radar, *Surface drainage, Mapping, Aerial photography, Clouds, Rain, Watersheds (Basins), Hydrologic data, Geomorphology, Instrumentation, River basins, Slopes, Stations, Mathematical studies, Topography, Lakes.
Identifiers: *K-band radar imagery, Drainage network.

The author describes in detail the use of radar techniques for drainage network analysis. Radar-image and map presentation comparison and the evaluation of the capabilities of the radar-imagery methods are also given. Radar imagery is especially suitable for reconnaissance studies of landforms where large coverage and great detail relative to image scale is desired. For example, a K-band image of terrain 10 mi wide has a scale of 1:200,000, but the drainage data available from the image is equal to that from a 1:62,500 topographic map. (Gabriel-USGS)
W70-01427

7B. Data Acquisition

THE CALCULATION OF NON-PARALLELISM OF GAMMA ACCESS TUBES, USING SOIL SAMPLING DATA,
Institute for Land and Water Management Research, Wageningen (Netherlands).
P. E. Rijtema.
J Hydrol, Vol 9, No 2, p 206-212, Oct 1969. 7 p, 3 tab, 1 ref.

Descriptors: *Nuclear moisture meters, *Gamma rays, *Calibrations, Soil moisture meters, Instrumentation, Density, Soil moisture, Soil water.
Identifiers: Gamma-ray moisture meters, Access tubes.

An equation has been derived to determine the errors due to non-parallelism of gamma access tubes with the aid of soil sampling data, taken from the direct environment of the measuring spot. It is shown that the determination of the change in moisture content is not very sensitive to errors due to non-parallelism. When the absolute values of moisture content are needed, it is always necessary to determine the errors due to non-parallelism of the access tubes. (Knapp-USGS)
W70-01262

SOLVING MULTI-WELL, RIVER GROUND WATER FLOW PROBLEMS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W70-01263

SOIL MOISTURE MEASUREMENT BY THE GAMMA TRANSMISSION METHOD,
Institute for Land and Water Management Research, Wageningen (Netherlands).
A. H. Ryhiner, and J. Pankow.
J Hydrol, Vol 9, No 2, p 194-205, Oct 1969. 12 p, 8 fig, 2 tab, 3 ref.

Descriptors: *Nuclear moisture meters, *Gamma rays, *Calibrations, Soil moisture meters, Instrumentation, Density, Soil moisture, Soil water.
Identifiers: Gamma-transmission soil moisture meters.

A discussion is given of the use of the gamma transmission method for the measurement of soil moisture variations. It is shown that a single calibration curve can be used for very different soils. An approach is presented for the determination of the build-up factor of scattered radiation and for the instrumental resolution time. It appeared possible to calculate the systematic errors due to non-parallelism of the access tubes. (Knapp-USGS)
W70-01265

INTERFLOW OR SHALLOW PHREATIC FLOW IN THE COASTAL PLAIN OF GEORGIA,
Agricultural Research Service, Tifton, Ga. Southeast Watershed Research Center, and Georgia Agricultural Experiment Station, Athens.
For primary bibliographic entry see Field 02G.
W70-01266

PRACTICAL UTILIZATION OF A NEUTRON SOIL-MOISTURE METER FOR HYDROLOGIC MEASUREMENTS: INITIAL RESULTS OBTAINED FROM AN INCLINED BASIN OF TAFAINA, REPUBLIC OF MADAGASCAR (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
For primary bibliographic entry see Field 02G.
W70-01280

REEVALUATING THE MEASUREMENTS OF SOLID DISCHARGES IN SUSPENSION, REPUBLIC OF CHAD (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
For primary bibliographic entry see Field 02J.
W70-01281

RECORDER CHART PROCESSING OF HYDROMETEOROLOGICAL AND HYDROLOGIC DATA AT THE HYDROLOGICAL SECTION OF THE HYDROLOGY SEC-

TION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM (FRENCH),
Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
For primary bibliographic entry see Field 07A.
W70-01284

THERMAL NEUTRON SCATTERING MEASUREMENTS IN WATER,
Gulf General Atomic, Inc., San Diego, Calif.
For primary bibliographic entry see Field 01A.
W70-01296

SEEPAGE DETECTION BY REMOTE SENSING,
HRB Singer, Inc., State College, Pa. Radiometric Lab.
Thomas R. Ory.
Proc 2nd Seepage Symp, Phoenix, Ariz, Mar 25-27, 1968, Agr Res Serv Rep 41-147, p 128-133, 1969. 6 p, 4 fig, 2 tab.

Descriptors: *Seepage, *Canal seepage, *Remote sensing, Radar, Infrared radiation, Aerial photography, Water temperature, Evaporation, Solar radiation.
Identifiers: Seepage detection.

A number of remote sensing techniques have been shown to have application in the detection and evaluation of seepage. Radar and infrared sensors are presently available for use in seepage detection research and, to a limited extent, for operational work. When these sensors are used after a careful analysis of the detection problem, and with utilization of the information available from conventional techniques, the success probability of remote seepage detection should be very good. Future research will undoubtedly yield less expensive and more reliable remote sensors for this application as the payoffs from initial employment begin to stimulate their use. (Knapp-USGS)
W70-01423

A DEEP-SEA ELECTRICAL RESISTIVITY PROBE FOR MEASURING POROSITY AND DENSITY OF UNCONSOLIDATED SEDIMENTS,
SACLANT ASW Research Centre, La Spezia (Italy).
For primary bibliographic entry see Field 02L.
W70-01429

SEISMIC ATTENUATION OF GULF COAST SEDIMENTS,
Esso Production Research Co., Houston, Tex.
For primary bibliographic entry see Field 02L.
W70-01432

PHYSICAL PROPERTIES OF MARINE SEDIMENTS AS RELATED TO SEISMIC VELOCITIES,
Texas Instruments, Inc., Dallas.
For primary bibliographic entry see Field 02L.
W70-01433

METEOROLOGICAL APPLICATIONS OF REFLECTED RADIANCE MEASUREMENTS FROM ATS 1 AND ATS 3,
Wisconsin Univ., Madison. Space Science and Engineering Center.
Thomas H. Vonder Haar.
J Geophys Res, Vol 74, No 23, p 5404-5412, Oct 20, 1969. 9 p, 6 fig, 1 tab, 9 ref.

Descriptors: *Meteorology, *Meteorological data, *Radiation, *Satellites (Artificial), *Instrumentation, Cameras, Analog models, Digital computers, Photogrammetry, Sampling, Mapping, Clouds, Cloud physics.
Identifiers: Satellite reflected-radiance measurement.

Relative and absolute values of reflected radiance on a nearly continuous basis during the daytime over a large region of the earth's surface were evaluated using the satellites ATS-1 and ATS-3 to measure the sun-reflected energy. High resolution and a wide dynamic range of the satellite-borne cameras offer new possibilities for meteorological reasearch. (Gabriel-USGS)
W70-01436

NITRATE DETERMINATION IN SOIL EXTRACTS WITH THE NITRATE ELECTRODE,
Norges Landbrukshoegskole, Vollebekk. Inst. of Soil Science; and Norges Landbrukshoegskole, Vollebekk. Chemical Research Lab.
For primary bibliographic entry see Field 02K.
W70-01437

OCEANOGRAPHIC PROFILING WITH IMPROVED VERTICAL RESOLUTION,
Hawaii Inst. of Geophysics, Honolulu.
Volker Graefe, and Brent Gallagher.
J Geophys Res, Vol 74, No 23, p 5425-5431, Oct 20, 1969. 7 p, 4 fig, 5 ref.

Descriptors: *Oceanography, *Profiles, *Instrumentation, Ships, Isotherms, Electronic equipment, Salinity, Water temperature, Hydrographs, Water properties.
Identifiers: Oceanographic profiling.

Two techniques have been developed for obtaining high-resolution vertical profiles of oceanographic variables. The methods increase the spatial resolution of lowered sensors by removing the influence of vertical ship motions. Both telemetry and retrieval are accomplished easily. Used with the STD recorder, the methods allow the resolution of features whose vertical extent is a few decimeters. This permits smaller, laterally homogeneous layers to be distinguished and contrasted with morphological features intersecting isopycnal and isothermal surfaces and will make possible more comprehensive surveys of physical microstructure. (Gabriel-USGS)
W70-01445

PRETREATMENT PLANT FOR WOOL FACTORY EFFLUENT: WEAR AND TEES RIVER BOARD.
For primary bibliographic entry see Field 05D.
W70-01500

7C. Evaluation, Processing and Publication

TEMPERATURE OF SURFACE WATERS IN MONTANA,
Geological Survey, Helena, Mont.
Fern C. Aagaard.
Montana Fish and Game Dep Rep, 1969. 613 p, 4 fig, 3 tab.

Descriptors: *Water temperature, *Montana, *Streams, *Lakes, *Data collections, Streamflow, Water quality, Missouri River, Gaging stations, Hydrologic data.
Identifiers: *Montana Fish and Game Commission, Upper Columbia River basin, Hudson Bay basin, Fishlife.

This publication is a compilation, in tabular and graphic form, of all available surface water temperature data in the State of Montana through 1965. The data were obtained from Federal and State Agencies, cities and private industries. The report includes records of water temperatures at 272 sites on streams and lakes ranging from spot observations at time of discharge measurements or water quality samples to continuous record by a recording thermograph. Copies are available from the Montana Fish and Game Department, Helena, Mont. (Aagaard-USGS)
W70-01250

RECORDER CHART PROCESSING OF HYDROMETEOROLOGICAL AND HYDROLOGIC DATA AT THE HYDROLOGICAL SECTION OF THE HYDROLOGY SECTION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM (FRENCH),
Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
For primary bibliographic entry see Field 07A.
W70-01284

SUBSURFACE IMPLICATIONS FROM SURFACE HYDROGRAPH ANALYSIS,
Georgia Inst. of Tech., Atlanta. School of Engineering.
For primary bibliographic entry see Field 02A.
W70-01421

SUBSURFACE FLOW REGIMES OF A HYDROLOGIC WATERSHED MODEL,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02A.
W70-01424

ORCENT - A DIGITAL COMPUTER PROGRAM FOR SATURATED AND LOW SUPERHEAT STEAM TURBINE CYCLE ANALYSIS,
Oak Ridge National Lab., Tenn.
H. I. Bowers.
Report ORNL-2395, Jan 1969. 89 p, 6 fig.
Identifiers: *Programs (Computers), *Steam cycle, *Turbines, AEC sponsored, Coupling (Reactor-desalting plant), Dual-purpose plant, Feedwater heating, Flowsheets, Heat balance, Nuclear desalination, Single-purpose plant, Turbine-generators.

The program will perform full-load, design point calculations for steam turbine cycles supplied with throttle steam characteristic of contemporary water reactor power plants and will handle both condensing and back-pressure turbine exhaust arrangements. Turbine performance calculations are based on the General Electric Company method for large steam turbine-generators operating with saturated and low superheat throttle steam. Output includes all information normally shown on a turbine cycle heat balance diagram. The program is written in FORTRAN IV for the IBM 360/75 computer at Oak Ridge National Laboratory.
W70-01529

08. ENGINEERING WORKS

8A. Structures

COST STUDY OF PRODUCT WATER CONVEYANCE AND ELECTRIC POWER TRANSMISSION FOR LARGE NUCLEAR DUAL-PURPOSE PLANTS.
Parsons Ralph M. Co., Los Angeles, Calif.

Report prepared for ORNL Under Subcontract 2863, Aug 1967. 130 p, 43 fig.
Identifiers: *Canals, *Pipelines, *Power transmission costs, *Water conveyance, *Water conveyance costs, Capitalized costs, Construction costs, Dual-purpose plant economics, Economic evaluations, Fixed charge rate, Offshore island sitting, Operating costs, Parametric studies, Power transmission systems, Right-of-way acquisition, Seawater intake and discharge systems, Site selection criteria.

Graphs are given for the costs for conveying product water from a plant to a delivery point from 0 to 100 miles away as a function of the important variables that determine these costs. Water lifts of 0 to 1500 ft and flows of 100 to 1000 mgd are considered. Similar curves are given for seawater intake and discharge lines. A general commentary covers open canals, pressure and nonpressure pipes, tunnels, land requirements, site locations

and intake and discharge systems. The cost of electric power transmission from the plant to a load center is given graphically for 250- to 2500-mw plants for distances of 0 to 100 miles.
W70-01564

8B. Hydraulics

ON THE PENETRATION OF A TURBULENT LAYER INTO STRATIFIED FLUID,
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
H. Kato, and O. M. Phillips.
Journal of Fluid Mechanics, Vol 37, Part 4, p 643-655, (1969). 9 ref, 6 fig.

Descriptors: *Stratification, *Turbulence, Model studies, Winds.
Identifiers: Entrainment.

The aim of this study was to explore the possibility of generating a turbulent layer not by direct stirring but by the application of a known horizontal stress at the upper ('free') surface of a stratified fluid and to make preliminary measurements of the rate at which the layer penetrates into the underlying fluid. The model was an annular tank at the surface of which a constant stress could be applied in the circumferential direction. The development of the turbulent layer by entrainment of the underlying fluid is described and it is found that the entrainment coefficient E, the ratio of the entrainment velocity u sub e to the friction velocity u sub * is given in terms of the depth D of the mixed layer and the density jump delta (rho) across the entrainment interface by the relation: E= (u sub e)/ (u sub*)= 2.5 (rho sub o) (u sq sub*)/g (delta) (rho)D. The form of these results is consistent with those found by Turner with an agitation tank, but the parameters used here allow direct application to entrainment in the ocean. (Guerrero-Vanderbilt)
W70-01383

JET DIFFUSION IN THE REGION OF FLOW ESTABLISHMENT,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
Sedat Sami, Thomas Carmody, and Hunter Rouse.
Journal of Fluid Mechanics, Vol 27, Part 2, p 231-252, 1967. 24 fig, 21 ref.

Descriptors: *Jets, *Diffusion, *Turbulence, *Flow, Nozzles, Turbulent flow, Flow measurement, Flow profiles.
Identifiers: Mean flow equation.

The purpose of this study was to study the mean flow and the turbulence characteristics of a diffusing jet through the measurements of all the terms of the mean energy equation for the diffusing jet. A nozzle diameter of 1.0 ft. with an efflux velocity of about 35 ft/sec was used to determine the flow characteristics. Four types of probes were used: a static tube for mean ambient pressure; a single wire anemometer probe, for the axial components of the mean velocity and of the fluctuation, the autocorrelation, the dissipation length, and the intermittency factor; a cross wire anemometer probe, for both the axial and radial components of the mean velocity, the three (axial, radial, and tangential) components of the fluctuation, and the turbulent shear; and a piezo-electric ceramic probe was developed for the measurement of the pressure fluctuation. Also in the measurements was included the temporal mean gradient. Hot wire and pressure-probe transverses were carried out at sections with x/D ratios from 1 to 20. Conclusions were: (a) The fluctuating-pressure and turbulence-intensity fields were observed to be closely similar in form, (b) A detailed evaluation of all the terms of the momentum and mean-energy equations for the region of flow establishment, in both integral and differential forms, indicates that a satisfactory representation of the mean flow is now at hand. (Guerrero-Vanderbilt)
W70-01387

AN EXPERIMENTAL STUDY OF TURBULENCE IN A DENSITY-STRATIFIED SHEAR FLOW,
Manchester Univ. (England). Dept. of the Mechanics of Fluids.
C. A. G. Webster.
Journal of Fluid Mechanics, Vol 19, p 221-245, (1964). 19 ref, 24 fig, 4 tabl.

Descriptors: *Density stratification, *Turbulence, *Winds, *Flow measurement, Conductivity, Viscosity, Shear, Wind velocity.
Identifiers: *Richardson number.

The purpose of this study was the investigation of turbulence in the density stratified shear flow of a specially designed wind tunnel in which the density gradient is created by differential heating of the air. The heated shear-flow wind tunnel is a small tunnel, nominally 0.5 m. square in section in which essentially linear temperature and velocity gradients extend over an appreciable depth of the flow. Mean temperature and temperature gradients were measured using thermometers and thermocouples, and a method of measuring low wind speeds based on the periodic shedding of vortices by a circular cylinder was discussed and used. Also, a hot-wire anemometer was used. The characteristics measured were the stream-wise and vertical components of the turbulence together with the temperature fluctuation at the same point. Conclusions were: (a) The experiments have produced much new information concerning the variation with stability of the various quantities associated with turbulence and turbulent transport processes, and at the same time indicating the possibility of a detailed study of these flows. (b) It was not possible to attain steady state conditions. The indications were that a doubling, or even a trebling, of the linear dimensions of the apparatus would be necessary to do so. (c) The results obtained serve to confirm that the ratio (Eddy conductivity/Eddy viscosity) falls with increasing Richardson number. (Guerrero-Vanderbilt)
W70-01389

TURBULENT BUOYANT CONVECTION FROM A SOURCE IN A CONFINED REGION,
Cambridge Univ. (England). Dept. of Applied Mathematics.
W. D. Baines, and J. S. Turner.
Journal of Fluid Mechanics, Vol 37, Part 1, p 51-80, (1969). 13 ref, 11 fig.

Descriptors: *Buoyance, *Turbulence, Convection.
Identifiers: Entrainment.

This paper considers the effect of continuous convection from small sources of buoyancy on the properties of the environment when the region of interest is bounded. The main assumptions are that the entrainment into the turbulent buoyant region is at a rate proportional to the local mean upward velocity, and that the buoyant elements spread out at the top of the region and become part of the non-turbulent environment at that level. A time-dependent solution is sought which takes into account the possible modification of the environment by the buoyant elements with subsequent effects on the plume. Asymptotic solutions, valid at large times, are obtained from the cases of plumes from point and line sources and also periodically released thermals. The analysis is carried out in detail for the point source in an environment of constant cross-section. Laboratory experiments have beem conducted for this case, and these verify the major predictions of the theory. It is then shown how the method can be extended to include more realistic starting conditions for the convection, and a general shape of bounded environment. Finally, the model is applied quantitatively to a variety of problems in engineering, the atmosphere and the ocean, and the limitations on its use are discussed. (Guerrero-Vanderbilt)
W70-01390

RIP CURRENTS: 1. THEORETICAL INVESTIGATIONS,
Liverpool Univ. (England). Tidal Inst.
For primary bibliographic entry see Field 02E.
W70-01431

8C. Hydraulic Machinery

AUTOMATION OF SURFACE IRRIGATION WITH FLUIDIC DIVERTERS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W70-01482

EVALUATION OF ALL POTENTIAL SOURCES OF ENERGY FOR DESALTING,
Ebasco Services, Inc., New York.
F. L. C. Reichle.
Proc Intern Symp Water Desalination, 1st, 1965, Washington 1, 604-19, (1967). 9 fig. Paper No SWD/121.
Identifiers: *Dual-purpose plant economics, *Economic evaluations, *Energy sources, *Nuclear desalination, Base-load, Distillation processes, Fossil fuels, Freeze processes, Nuclear energy sources, Osmosis, Peaking power.

Minor sources of energy (solar, geothermal, waste heat, and hydro) may serve best in a few special situations where fresh water demand is small and the source of energy available near the point of need. Major sources of energy (gas, oil, coal, and nuclear) may be optimum, depending on the process used and the salinity of water to be converted. The lowest cost steam or electric energy for desalting can usually be obtained by integrating the energy requirements with an established electric utility system. There is potential for future development in use of off-peak electric power for desalting brackish water by electrodialysis or for such processes as reverse osmosis, freezing, and vapor compression which require relatively small amounts of mechanical energy for desalting either brackish or seawater compared to the large amounts of thermal energy required for distribution processes.
W70-01522

GAS TURBINES PROVE EFFECTIVE FOR DESALINATION,
Stal-Laval Turbine Co., Finspang, Sweden.
N. O. Lier.
Power 112 (11), 79-81 (1968). 7 fig.
Identifiers: *Gas turbines, Energy sources, Multistage flash distillation, Vapor compression evaporation, Vertical tube evaporators, Water costs estimate.

A brief comment on the possible use of a 50-MW industrial gas turbine generator as a prime mover and MSF heat source. Normal performance of such a turbine is 47.8-MW output and 193-MBTU/HR available heat in the exhaust gas at 265 deg F. Available heat in the intercooler is 135 MBTU/HR. With this heat, the gas turbine plus straight MSF will give 41.5 MW of saleable power and 7.0 MGD of fresh water. By adding a vapor compressor and two vertical tube evaporators, the system can produce 20.0 MW of saleable power and 19.0 MGD of water. Various combinations of these are possible to provide a wide range of water/power ratios. Assuming 25 cents/MBTU fossil fuel and 6 MIL/KWH sale of power, a gas turbine and MSF plant could produce water for 26 cents/1000 gal, while water from a steam turbine with MSF would result in 41.5 cents/1000 gal water. If we assume 3.5 cents/MBTU fuel and 6 MIL power, the gas turbine with MSF results in a profit of 19.5 cents/1000 gal (a cost of -19.5) and the steam turbine and MSF would have a profit of 1.5 cents/1000 gal. A 400-MW (saleable) nuclear plant producing 72 MGD (selling 6 mil power) would have a water cost of 34.5 cents/1000 gal.
W70-01523

FRESH WATER FROM NUCLEAR POWER WITH THE AGR AND SGHWR,
United Kingdom Atomic Energy Authority, Risley (England).
G. R. Bainbridge.
Presented at IAEA Regional Survey Course on Problems and Prospects of Nuclear Power Applications in Developing Countries, Santiago, Chile, Dec 4-7, 1967. 13 p, 11 fig. Report No TRG 1691 (R).
Identifiers: *Dual-purpose plant, *Nuclear energy sources, Energy sources, Parametric studies, Water costs estimate, 0-500 MW (E) reactors, 500 plus MW (E) reactors, 51-250 MGD plant.

Typical parameters were developed for two dual-purpose systems with a gas-cooled reactor, the AGR, or a steam generating heavy water moderated (and light water cooled) reactor, the SGHWR. The AGR parametric design is for 400 MWE net electrical output and 67.5 MGD of fresh water, while the SGHWR design is for 20C MWE and 94.5 MGD. There is scope for varying the proportions of electricity and water products to suit the market. The AGR design is capable of 42% station efficiency if used mainly as an electricity producer. Because of this (the UK has adequate natural water resources at present), it is being built in large reactor-turbine unit sizes of 625 MWE at Dungeness, Hinkley Point, and Hunterston B stations with two reactor-turbine units at each site. Other similar units are planned to provide at least 3000 MWE of AGRS in a total nuclear capacity of 13,000 MWE of gas-cooled reactor stations by 1975. The SGHWR design would give a station efficiency around 33% as an electricity producer. An SGHWR power station in final stages of development (Dec. 1967) at Winfrith Heath will make possible production of either 400 MWE or 200 MWE plus 94.5 MGD of fresh water. Conclusions are that for extrapolating to very large outputs (exceeding 1200 MWE) the AGR is most suitable, while the SGHWR is best for plants below 400 MWE.
W70-01525

A FUEL CYCLE ECONOMIC ANALYSIS OF OXIDE FUELED POWER AND PROCESS HEAT PWR FOR SEAWATER DESALINATION,
Oak Ridge National Lab., Tenn.
E. P. Rahe, Jr., J. E. Jones, Jr., and T. T. Robin.
Report ORNL-TM-2046, Jan 1969. 59 p, 7 fig, 20 tab, 17 ref.
Identifiers: *Economic evaluations, *Nuclear fuel cycle costs, AEC sponsored, Fuel costs, Municipal financing, Nuclear fuel processing studies, Pressurized-water reactors, Private financing, Process heat, Thermal-hydraulic design, 3000 plus MW (T) reactors.

Economic studies were conducted to determine minimum equilibrium fuel cycle costs for two oxide fueled PWR concepts. Each reactor is to be used to generate steam for a single-purpose desalination plant. The two reactor concepts studied were a commercial product line power reactor and a lower temperature process heat reactor. Fuel cycle costs were based on economic ground rules believed to be representative for reactors going on-line in 1980-90. The study indicated that, for a publicly owned reactor utilizing a privately owned 75,000 MWT capacity fabrication plant, equilibrium fuel cycle costs of 0.348 MILLS/KWHR (T) and 0.324 MILLS/KWHR (T) could be expected from commercial power and process heat reactors, respectively. These costs are based on an ore cost of $8.00/lb U308, a separative work charge of $26/KG U and a tails of 0.20 Wt.% U-235. For a privately owned reactor using the same fabrication-reprocessing complex, corresponding fuel cycle costs are .385 and .367 MILLS/KWHR (T). If the reactor is publicly owned and the complex is publicly owned with a 15,000 MWTH industry capacity, equilibrium fuel cycle costs are 0.402 and 0.381 MILLS/KWHR (T), respectively.
W70-01527

THE UNCLAD-METAL BREEDER REACTOR (UMBR) FOR DESALTING OR POWER,
Oak Ridge National Lab., Tenn.
R. P. Hammond, C. C. Burwell, R. S. Carlsmith, J. G. Delene, and L. C. Fuller.
Report ORNL-4202, Jan 1969. 141 p, 32 fig, 63 ref.
Identifiers: *Economic evaluations, *Feasibility study, *Liquid-metal fast-breeder reactors, AEC sponsored, Breeder reactors, Energy costs, Energy sources, Nuclear design, Nuclear energy sources, Reactor design, 3000 plus MW (T) reactors.

The findings of preliminary investigations of sodium-cooled fast breeder reactors fueled with unclad metal to investigate the possibilities of producing low-cost low-temperature heat suitable for seawater distillation. Fuel materials considered are thorium-based thorium-uranium binary alloys, thorium-based thorium-uranium-plutonium ternary alloys, and uranium-based alloys. Together with the two unclad-metal blanket materials thorium and uranium - used singly or jointly, a number of reactor core combinations is possible. Use of unclad metals as core and blanket materials appears to be technically feasible, based on the incomplete available data. Good breeding gains and doubling times were calculated for all systems considered because of the absence of cladding and other diluents. The characteristics of two reactors fueled with the thorium-based thorium-uranium-plutonium ternary alloy combined with uranium blanket material are presented and the less desirable low-temperature all-uranium-based fuel system and the nearer term high-temperature all-thorium based fuel system are discussed briefly. The reactors considered are one designed primarily for low-temperature.
W70-01528

ORCENT - A DIGITAL COMPUTER PROGRAM FOR SATURATED AND LOW SUPERHEAT STEAM TURBINE CYCLE ANALYSIS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 07C.
W70-01529

CONSIDERATIONS AFFECTING STEAM POWER PLANT SITE SELECTION.
Office of Science and Technology, Washington, D.C.

Report, Dec 1968. 133 p, 110 ref.
Identifiers: *Energy sources, *Power growth surveys, *Site selection criteria, Air pollution, Dual-purpose plant, Exclusion zones, Fossil fuels, Multipurpose plant, Nuclear energy sources, Power requirements, Power transmission systems, Reactor siting, Reviews, Site preparations, Siting surveys.

The purpose of this report is to make available a factual presentation of the public interest considerations affecting generating site selection based on existing information. Many of the siting issues which are only now emerging are apt to become of crucial significance in the future. The report identifies such issues as the prospects and problems of metropolitan siting, undergrounding transmission lines, the need to protect scenic areas and the quality of our air and water and yet meet the nations need for reliable, low-cost power supply. It is clear that a greater effort in research and development and coordinated planning among all concerned interests is needed to achieve optimum solutions. The basic question which the report raises, but does not purport to answer, is what additional planning mechanisms or other actions are needed to identify and utilize in the public interest those prime sites which are best adapted to meeting the conflicting demands of environmental quality control, safety, and reliable economical electric power supply. Both fossil fuels and nuclear energy sources are considered. Dual-purpose as well as power-only plants are covered.
W70-01547

COST STUDY OF PRODUCT WATER CONVEYANCE AND ELECTRIC POWER TRANSMISSION FOR LARGE NUCLEAR DUAL-PURPOSE PLANTS.
Parsons Ralph M. Co., Los Angeles, Calif.
For primary bibliographic entry see Field 08A.
W70-01564

PROGRESS ON THE DESIGN OF MULTIFLASH EVAPORATORS,
Weir Westgarth Ltd., Glasgow (Scotland).
For primary bibliographic entry see Field 03A.
W70-01565

8F. Concrete

THE DURABILITY OF CEMENT AND CONCRETE IN SEA WATER,
Standards Institution of Israel, Tel Aviv.
M. Ben-Yair.
Desalination 3, 147-54, 1967, 5 fig, 11 ref. Presented at 2nd European Symp Fresh Water from Sea, Vol 4, Athens, May 1967.
Identifiers: *Concrete construction, *Concretes, *Construction joints (Concrete), Adhesives, Coatings, Fabrication materials, Protective coatings.

Described are results of basic and applied studies performed to clarify the mechanism of sulphate, chloride and magnesium attack on concrete, separately and together, as they occur in seawater, and methods of prevention. Resulting practical precautions suggested for construction of concrete buildings in seawater include (1) a dense and impermeable concrete must be produced under superior control conditions and used without joints or cracks, (2) the most suitable brand of cement and admixture must be selected in each case, e.g., Portland cement A.S.T.M. type I or V, trass, air entrainers, etc., and (3) external protective coatings must be used.
W70-01567

8G. Materials

SEA WATER CORROSION TEST PROGRAM,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 03A.
W70-01397

RATES OF REACTION OF DISSOLVED OXYGEN WITH SCAVENGERS IN SWEET AND SOUR BRINES,
Mobil Research and Development Corp., Dallas, Tex.
E. S. Snavely, and F. E. Blount.
Corrosion, Vol 25, No 10, p 397-404, Oct 1969. 8 p, 15 fig, 2 tab, 6 ref.

Descriptors: *Dissolved oxygen, *Corrosion, *Oxidation, *Corrosion control, Chemical reactions, Catalysts, Chemcontrol, Sodium sulfate, Hydrogen sulfide, Sulfides.
Identifiers: *Oxygen scavenging, Oxygen scavengers.

Rates of reaction of dissolved oxygen with hydrogen sulfide were measured in a laboratory apparatus using a polarographic-type instrument for the measurement of oxygen concentrations. Results show that oxidation occurs only at high pH in the absence of catalytic species. The reaction is catalyzed by transition metal ions in the order Ni, Co, Mn, Cu, Fe. In all cases, the reaction rate increases with pH and is at first complex but becomes zero-order with respect to oxygen after a brief introduction period. Some natural waters contain sufficient catalysts that additional amounts are not required for scavenging oxygen with sulfur dioxide or sodium sulfite. Sour waters cannot be scavenged with sulfur dioxide or sodium sulfite because of ineffectiveness of catalysts. (Knapp-USGS)
W70-01435

PITTING OF TITANIUM ALLOYS IN SALINE WATERS,
Oak Ridge National Lab., Tenn.
F. A. Posey, and G. G. Bohlmann.

Desalination 3, 269-79, 1967, 10 fig, 40 ref. Presented at 2nd European Symp Fresh Water from Sea, Vol 4, Athens, May 1967.
Identifiers: *Corrosion, *Corrosion tests, *Titanium, Corrosion problems, Evaporated-condenser tubes, Evaporators, Fabrication materials, OSW sponsored, Pitting (Corrosion).

Electrochemical aspects of the corrosion of titanium and a number of its alloys were studied in flowing, high-temperature salt solutions at temperatures up to 220 deg F in a titanium loop facility. Measured polarization curves show that a pitting potential exists at sufficiently high potentials for all the alloys. Increase of temperature greatly affects the temperature are reproducible and quite characteristic of each grade of titanium alloy and show clearly which alloys are superior in tendency towards pitting attack. The results suggest an upper temperature limit of usefulness for many titanium alloys without risk of severe localized attack. Alloys of titanium which contain molybdenum show promise for application in high-temperature saline waters.
W70-01569

RESEARCH ON CORROSION MECHANISMS IN SALINE WATER, USING REVERSIBLE AND IRREVERSIBLE ELECTRODES,
Battelle Memorial Inst., Columbus, Ohio.
P. D. Miller, A. B. Tripler, J. J. Ward, F. H. Hanie, and W. K. Boyd.
OSW R and D Progr Rept No 174, Apr 1966. 105 p, 22 fig, 31 tab, 48 ref.
Identifiers: *Corrosion mechanisms, *Thermogalvanic corrosion, Corrosion tests, Electrochemical corrosion, Fabrication materials.

Describes studies on corrosion mechanisms of metals in salt solutions using theoretical and experimental approaches. Investigations included research on corrosion cells driven by thermogalvanic potentials, use of irreversible thermodynamics to construct reaction models to fit experimental data, and use of potentiostatic and polarization techniques to follow electrode reactions. Different configurations of thermogalvanic cells were operated at temperatures ranging to 100 deg C. Sulfate and chloride solutions containing ions with which the electrodes were reversible were studied. Electrodes were made from pure aluminum, copper, iron, nickel, silver, titanium, and zinc. Irreversible thermodynamics helped explain the action of copper, nickel, and zinc thermal cells in sulfate electrolytes containing ions reversible to the electrodes. Calculations aided in predicting temperature coefficients for copper and nickel cells. The zinc system could not be explained completely. Thermogalvanic-cell corrosion was important under numerous conditions. Significantly, dissolved oxygen was not required necessarily for thermogalvanic corrosion to occur. A continuing effort would be necessary to apply these procedures to chloride systems and seawater. Results indicated progress is possible by coupling approaches from polarization studies with those from thermodynamic models and thermogalvanic cells.
W70-01571

8H. Rapid Excavation

BLASTING REGULATIONS.
For primary bibliographic entry see Field 06E.
W70-01340

09. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

MARINE RESEARCH, FISCAL YEAR 1968,
Smithsonian Institution, Washington, D.C. Science Information Exchange.
For primary bibliographic entry see Field 09D.
W70-01261

ATLANTIC STATES MARINE FISHERIES COMPACT.
For primary bibliographic entry see Field 06E.
W70-01318

9D. Grants, Contracts, and Research Act Allotments

MARINE RESEARCH, FISCAL YEAR 1968,
Smithsonian Institution, Washington, D.C. Science Information Exchange.
Monroe E. Freeman.
Nat Counc on Marine Resources and Eng Develop, Executive Office of the President, July 1969. 740 p, 2589 ref, 4 index.

Descriptors: *Bibliographies, *Reviews, *Oceans, *Research facilities, *Projects, Grants, Research equipment, Resource development, Water resources development, Laboratories, Governments, Institutions.
Identifiers: *Marine Research Catalog, Marine resources.

Marine Research--Fiscal Year 1968 is the product of an inventory of Federal and non-Federal organizations with ocean-related research programs and interests. It contains descriptive summaries of 2,589 unclassified projects which were funded, either for the first time or as continuing efforts, during that fiscal year. Associated with these projects, and identified by name and address, are 3,022 investigators; 457 contractors; 25 Federal supporting agencies; and 95 non-Federal sources of support. The projects referenced in the catalog cover basic and applied research on the marine environment and its resources. This environment is defined to comprise the oceans, the estuarine and coastal areas, and the Great Lakes. For purposes of project selection, contributors were requested to interpret the guideline definitions in a broad sense so that pertinent items would be overlooked. In addition to the summaries of the 2,589 projects, the catalog contains the following indexes: Subject Index, Investigator Index, Contractor Index, and Supporting Agency Index. Each project has been indexed to an average of five terms which are arranged in hierarchies indicating relationships between broader and narrower concepts. The index term is followed by the project title, additional keywords used in indexing, and the chapter and subchapter number of the project. (Knapp-USGS)
W70-01261

10. SCIENTIFIC AND TECHNICAL INFORMATION

THE BIOLOGICAL AND ECOLOGICAL EFFECTS OF ACID MINE DRAINAGE WITH PARTICULAR EMPHASIS TO THE WATERS OF THE APPALACHIAN REGION,
Washington Univ., Seattle. Coll. of Fisheries.
For primary bibliographic entry see Field 05C.
W70-01463

SELECTED BIBLIOGRAPHY ON THE CLIMATE OF THE CENTRAL AMERICAN COUNTRIES,
Environmental Technical Applications Center (Air Force), Washington, D.C.
Vincent J. Creasi.
USAF, Air Weather Service, ETAC Technical Note 69-7, September 1969. 27 p, 69 ref. Available from the Clearinghouse as AD695 482, $3.00 in paper copy, $0.65 in microfiche.

Descriptors: *Bibliography, *Climatology.
Identifiers: Central America.

This bibliography contains 69 climatological references, with annotations, for the Central American Countries. Items are indexed by author and subject matter. All but four of the items were published subsequent to 1959.
W70-01476

INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE - 3,
AEC, Oak Ridge National Lab., Tenn.
K. O. Johnson.
National Desalination Information Center, Report ORNL-NDIC-5, UC-80-Reactor Technology, May 1969. 63 p, 200 ref.

Descriptors: *Bibliographies, *Abstracts, *Desalination, Documentation, Distillation, Desalination processes, Desalination plants, Saline water systems.

Abstracts are given for approximately 200 published articles related to the desalination of seawater. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Nuclear Desalination Information Center (NDIC) at the Oak Ridge National Laboratory. The abstracts are grouped in nine categories (and repeated if they fall into more than one category). An author and a keyword index to the articles referenced is provided. The keywords, which identify the content of the articles, were chosen from a thesaurus developed by NDIC.
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Rutgers - The State University - Water Resources Economics	W70-01341 -- 01371 01375 -- 01380 01373	38
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University of Washington - Water Quality Requirements for Acquatic Organisms	W70-01458 -- 01473	16
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Vanderbilt University - Thermal Pollution	W70-01381 -- 01390 01392 -- 01395 01474 -- 01475	16
North Carolina State University - Textile Wastes	W70-01491 -- 01520 01398, 01479 01444, 01483	34
University of Wisconsin - Eutrophication	W70-01575 -- 01584	10
University of Arizona - Arid Lands Water Resources	W70-01484 -- 01486	3
B. Others:		
Oak Ridge National Laboratory	W70-01521 -- 01569 01571 -- 01573	52
National Agricultural Library	W70-01478	1
Office of Saline Water	W70-01480	1
Agricultural Research Service	W70-01482, 01481	2
Environmental Technical Applications Center	W70-01476	1
Federal Water Pollution Control Administration	W70-01487 -- 01489	3
	Total	395

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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 3, NUMBER 5
MARCH 1, 1970

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 5
MARCH 1, 1970

W70-01642 -- W70-02042

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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1B. Aqueous Solutions and Suspensions

SOLUBILITY OF CALCIUM CARBONATE PRECIPITATED IN AQUEOUS SOLUTIONS OF MAGNESIUM AND SULFATE SALTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02K.
W70-01648

SECOND REPORT ON THERMOPHYSICAL PROPERTIES OF SALINE WATER SYSTEMS,
Monsanto Research Corp., Everett, Mass.
For primary bibliographic entry see Field 03A.
W70-01754

02. WATER CYCLE

2A. General

CLIMATE AND THE OCEAN CIRCULATION: 1. THE ATMOSPHERIC CIRCULATION AND THE HYDROLOGY OF THE EARTH'S SURFACE,
Environmental Science Services Administration, Princeton, N.J. Geophysics Fluid Dynamics Lab.
For primary bibliographic entry see Field 02B.
W70-01853

CLIMATE AND THE OCEAN CIRCULATION: 2. THE ATMOSPHERIC CIRCULATION AND THE EFFECT OF HEAT TRANSFER BY OCEAN CURRENTS,
Environmental Sciences Services Administration, Princeton, N.J. Geophysics Fluid Dynamics Lab.
For primary bibliographic entry see Field 02B.
W70-01854

CLIMATE AND THE OCEAN CIRCULATION: 3. THE OCEAN MODEL,
Environmental Science Services Administration, Princeton, N.J. Geophysics Fluid Dynamics Lab.
For primary bibliographic entry see Field 02B.
W70-01855

DRAINAGE DESIGN THEORY AND PRACTICE,
Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experiment Unit.
E. U. Nwa, and J. G. Twocock.
J Hydrol, Vol 9, No 3, p 259-276, Nov 1969. 18 p, 10 fig, 2 tab, 15 ref.

Descriptors: *Drainage systems, *Soil water movement, *Groundwater movement, *Drainage engineering, Water management (Applied), Drainage practices, Evaluation, Design, On-site investigations, Mathematical studies, Model studies, Ditches, Drainage Programs, Agricultural engineering.
Identifiers: Drainage design theory.

Several drainage equations were chosen to compare them with the performance of an existing drainage scheme. A review of the drainage theories chosen is reported. The auger-hole method was used to determine the average hydraulic conductivity used in the calculation, and the variable drainable porosity was determined using Taylor's method. The drain discharge and the shape of the water table were determined by means of a flowmeter, and lines of piezometers, respectively. Two rainfree periods were selected for the experiment. The water table profile tends to indicate an essentially flat water surface. All the equations tested, except Luthin's, gave an average calculated spacing which is larger than the actual spacing. It is concluded that the site could perform as well as it is doing now with a wider spacing. More research is recommended before one or two equations could be chosen to aid the design of drainage schemes. (Knapp-USGS)
W70-01877

BLUEPRINT FOR A PHYSICALLY-BASED, DIGITALLY-SIMULATED HYDROLOGIC RESPONSE MODEL,
Department of Energy, Mines and Resources, Calgary (Alberta). Inland Waters Branch; and Department of Fisheries and Forestry, Calgary (Alberta). Forestry Branch.
R. Allan Freeze, and R. L. Harlan.
J Hydrol, Vol 9, No. 3, p 237-258, Nov 1969. 22 p, 6 fig, 33 ref.

Descriptors: *Mathematical models, *Streamflow, *Groundwater movement, *Soil water movements, *Reviews, Rainfall-runoff relationships, Hydrology, Hydrogeology, Surface-groundwater relationships, Simulation analysis, Parametric hydrology, Synthetic hydrology, Model studies, Saturated flow, Unsaturated flow.
Identifiers: Hydrologic model studies.

Recent developments in hydrologic model studies, simulation analysis, computer models, and mathematical descriptions of flow systems are reviewed. Meaningful results are now available in the form of numerical solutions to mathematical boundary value problems for groundwater flow, unsaturated porous media flow, overland flow, and channel flow. These developments in physical hydrology, together with the tremendous advance in digital computer technology, should provide the impetus for a necessary redirection of research in hydrologic simulation. A blueprint for the development of physically-based hydrologic response models is presented; the level of sophistication that can be achieved with presently available methodology is discussed; and areas for necessary future research are pinpointed. (Knapp-USGS)
W70-01878

HYDROGEOLOGIC STUDY OF MAMORA, (FRENCH),
Morocco Geological Service, Rabat.
Jean-Pierre Thauvin.
Notes et Mem du Serv Geol Morocco, No 195, 1966. 119 p, 37 fig, 8 profiles 4 map, 45 ref, 2 append.

Descriptors: *Hydrogeology, *Geology, *Soils, *Climates, Surface waters, Groundwater, Aquifers, Water balance, Temperature, Precipitation (Atmospheric), Hydrologic data, Gaging stations, Permeability, Geophysics, Water chemistry.
Identifiers: *Morocco, Mamora.

This monograph describes the hydrogeology of the Mamora plateau, Morocco. The discussion includes: the earth (geology, geography, soil and vegetation); the water (climates, surface hydrology); hydrogeology (hydrogeologic structure of the Mamora plateau, subsurface hydraulics, the Mamora aquifers, and water balance). (Gabriel-USGS)
W70-01911

2B. Precipitation

RAINFALL PATTERNS ON THE KAWEKA RANGE,
Ministry of Works, Napier (New Zealand). Water and Soil Div.
P. J. Grant.
J Hydrol (New Zeal), Vol 8, No 1, p 17-34, 1969. 18 p, 8 fig, 7 tab, 17 ref, 1 append.

Descriptors: *Rainfall disposition, *Topography, *Distribution patterns, Rainfall, Statistical methods, Sampling, Rain gages, Rainfall-runoff relationships, Data collections.
Identifiers: *New Zealand, Kaweka Range (New Zeal).

Rainfall patterns are based on records from 17 storage rain gages in the rangeland area, and from daily rain-gage stations surrounding the Kaweka Range, New Zealand. Correlations between storage and daily reference stations, using rainfall amounts for corresponding periods, determined the affinities of the storage stations and indicated that three distinct directional influences exist. In relation to the Kaweka Range these are recognized as the N, SW, and SE regimes or sectors. Annual rainfalls attain about 150 in. in the highest part of the range. For a given altitude rainfall totals are lower in the northern area than on the southern Kaweka Range. The SW sector is the least variable--about 10%. The seasonal and monthly patterns of rainfall are presented as percentages of annual norms, and it is shown how approximate seasonal or monthly values may be derived for any rangeland area. (Knapp-USGS)
W70-01686

A NOTE ON RANDOM RAIN-GAUGE ERRORS,
Otago Univ., Dunedin (New Zealand).
For primary bibliographic entry see Field 07A.
W70-01693

RAINFALL PATTERNS IN THE CENTRAL NEGEV DESERT,
National and Univ. Inst. of Agriculture, Rehovoth (Israel).
L. Shanan, M. Evenari, and N. H. Tadmor.
Israel Exploration Journal, Vol 17, No 3, 1967, p 163-184. 3 tab, 13 fig, 28 ref.

Descriptors: *Rainfall, *Variability, *Dendrochronology, *Climatic data, *Arid lands, Rainfall intensity, Frequency, Cycles, Forecasting, Precipitation (Atmospheric), Growth rate, Plant growth, Annual, Monthly.
Identifiers: *Israel, *Negev Desert, Beersheba, Climatic cycles, Intensity-duration.

The study reported here is concerned with rainfall variability and its impact on agriculture in the Negev Desert in southern Israel. Rainfall in the Negev occurs only in the winter months. It was found that the 45 year span of rainfall records at Beersheba were representative of all other stations in the Negev. Dendrochronological studies showed that annual growth of Zygophyllum dumosum correlated with rainfall at Beersheba. Thus, a 250 year rainfall record was derived. Annual Negev highland rainfall was found to have fluctuated near a mean of 86 mm with a cyclic variation of 28 mm every 50 years. 50 years of above average precipitation were followed by 50 years below average. Fluctuations and trends are in turn correlated with world wide climatic trends as indicated by temperature change, sea level changes, and sunspot activity. Results of the study suggest that additional dendrochronological studies would be useful for predicting trends in the million ha. Negev region. (Crouse-Arizona)
W70-01815

THE 'EL NINO' PHENOMENON AND RAINFALL IN PERU AND ECUADOR,
Texas A and M Univ., College Station. Dept. of Meteorology; and Texas A and M Research Foundation, College Station.
For primary bibliographic entry see Field 03B.
W70-01816

THE ISRAELI ARTIFICIAL RAINFALL STIMULATION EXPERIMENT. STATISTICAL EVALUATION FOR THE PERIOD 1961-65,
Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 03B.
W70-01821

CLIMATE AND THE OCEAN CIRCULATION: 1. THE ATMOSPHERIC CIRCULATION AND THE HYDROLOGY OF THE EARTH'S SURFACE,
Environmental Science Services Administration, Princeton, N.J. Geophysics Fluid Dynamics Lab.

Syukuro Manabe.
Monthly Weather Rev, Vol 97, No 11, p 739-774, Nov 1969. 36 p, 55 fig, 49 ref, append.

Descriptors: *Climatology, *Ocean circulation, *Mathematical models, Ocean currents, Weather, Heat budget, Heat balance, Hydrology, Water temperature, Hydrologic budget, Hydrologic cycle, Atmospheric physics.
Identifiers: General atmospheric circulation model.

The effect of the hydrology of the earth's surface is incorporated into a numerical model of the general circulation of the atmosphere, using the primitive equation of motion. The nine levels of the model are distributed so as to resolve the surface boundary layer and stratosphere. The depletion of solar radiation and the transfer of the terrestrial radiation are computed taking into consideration cloud and atmospheric absorbers such as water vapor, carbon dioxide, and ozone. The scheme involves the prediction of water vapor in the atmosphere and the prediction of soil moisture and snow cover. In order to represent the moisture-holding capacity of soil, the continent is assumed to be covered by boxes, which can store limited amounts of water. The ocean surface is idealized to be a completely wet surface without any heat capacity. The temperature of the earth's surface satisfies the condition of heat balance. The horizontal distribution of rainfall is in excellent qualitative agreement with the observations. Some features of the spatial distributions of heat and water balance components at the earth's surface also agree well with those obtained by Budyko for the actual atmosphere. (Knapp-USGS)
W70-01853

CLIMATE AND THE OCEAN CIRCULATION: 2. THE ATMOSPHERIC CIRCULATION AND THE EFFECT OF HEAT TRANSFER BY OCEAN CURRENTS,
Environmental Sciences Services Administration, Princeton, N.J. Geophysics Fluid Dynamics Lab.
Syukuro Manabe.
Monthly Weather Rev, Vol 97, No 11, p 775-805, Nov 1969. 31 p, 54 fig, 1 tab, 22 ref.

Descriptors: *Climatology, *Ocean circulation, *Mathematical models, Ocean currents, Weather, Heat budget, Heat balance, Hydrology, Water temperature, Hydrologic budget, Hydrologic cycle, Atmospheric physics, Evaporation.
Identifiers: General atmospheric circulation model.

A general circulation model of the joint ocean-atmosphere system is constructed by combining an ocean model and an atmospheric model. The quantities exchanged between the oceanic part and the atmospheric part of the joint model are momentum, heat, and water. Integration of the atmospheric part yields the surface wind stress, net radiation, sensible heat flux, rates of rainfall and snowfall, rates of evaporation and sublimation, and rates of runoff and iceberg formation, all of which constitute the upper boundary conditions for the oceanic part of the model. From the oceanic part, the thickness of ice and the distribution of sea-surface temperature, which constitute the lower boundary conditions for the atmospheric part of the model, are computed. Since the thermal relaxation time of the oceanic part of the model is much longer than that of the atmospheric part, a special technique for economizing the computation time is developed. A detailed analysis of the final solution at the end of the integration is carried out. According to this analysis, the distributions of various heat balance components such as radiation flux and the turbulent flux of sensible and latent heat compare favorably with the corresponding distributions in the actual atmosphere. It is possible to identify the effect of an ocean circulation on the general circulation of the atmosphere. (Knapp-USGS)
W70-01854

CLIMATE AND THE OCEAN CIRCULATION: 3. THE OCEAN MODEL,
Environmental Science Services Administration, Princeton, N.J. Geophysics Fluid Dynamics Lab.
Kirk Bryan.
Monthly Weather Rev, Vol 97, No 11, p 806-827, Nov 1969. 22 p, 18 fig, 6 tab, 28 ref.

Descriptors: *Climatology, *Ocean circulation, *Mathematical models, Ocean currents, Weather, Heat budget, Heat balance, Hydrology, Water temperature, Hydrologic budget, Hydrologic cycle, Atmospheric physics, Evaporation.
Identifiers: General atmospheric-oceanic model.

An ocean model used in a calculation of the earth's climate is described in detail. Temperature and salinity are treated separately. Density is calculated with an accurate equation of state for sea water. The model also includes a method for calculating the growth and movement of sea ice. Due to the very slow adjustment of the deep water in the ocean model, a numerical integration extending over the equivalent of a century fails to reach a climatic equilibrium. At the termination of the run, the surface layers of the ocean show little change with respect to time, but the average heating rate for the ocean as a whole is 2 deg per century. The salinity patterns at the termination of the run are highly realistic compared to observations. The calculation indicates that the thermal 'relaxation' time of the ocean is too long for a numerical integration of the time-dependent equations to be a practical method of finding an equilibrium solution, and new methods should be sought for future calculations of this type. (Knapp-USGS)
W70-01855

A PRELIMINARY STUDY OF STORM MAXIMIZATION BY MOISTURE CHARGE METHOD,
Institute of Tropical Meteorology, Poona (India).
O. N. Dhar, and P. R. Mhaiskar.
Indian J Meteorol and Geophys, Vol 19, No 4, p 427-430, Oct 1968. 4 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Storms, *Design storm, *Rain, *Moisture, Moisture availability, Surveys, Mapping, Seasonal, Rainfall, Dew, Floods, Design flood, Distribution patterns, Meteorology.
Identifiers: *India, Maximum rainstorm.

Calculation of maximum rainstorms by moisture charge has been attempted for the southern half of the Indian Peninsula from Latitude 8 deg N to about Latitude 12 deg N. The use of the moisture charge method is based on the following assumptions: the rainfall can be expressed as the product of available moisture, storm efficiency, and inflow wind; the most effective combination of storm efficiency and inflow wind has been closely approached in the major storms recorded in the area. The average maximization factors range from 2 to 26% and these are generally low during the months of October to December. (Gabriel-USGS)
W70-01864

A BRIEF STUDY OF RAINFALL AND SPILLWAY DESIGN STORM FOR THE GODAVARI BASIN UP TO PAITHAN DAM SITE,
Institute of Tropical Meteorology, Poona (India).
O. N. Dhar, P. R. Mhaiskar, and G. C. Ghose.
Indian J Meteorol and Geophys, Vol 19, No 4, p 413-420, Oct 1968. 8 p, 6 fig, 4 tab, 1 ref.

Descriptors: *Rainfall, *Design storm, *Design criteria, Dams, River basins, Variability, Lakes, Rivers, Mapping, Monsoons, Seasonal, Frequency analysis, Statistical methods.
Identifiers: *India, Spillway design rainstorm.

Mean monthly and annual rainfall data for the Godavari basin up to the Paithan damsite, India, were analyzed using the isohyetal method. Seventy three heaviest rain spells in the 1891-1963 period were analyzed by means of the depth-duration method, as well as by Gumbel's statistical method. The mean annual rainfall is about 29 inches and the coefficient of variability is the highest in the central part of the Godavari River basin, about 40 to 44% for monsoon rainfalls. (Gabriel-USGS)
W70-01865

RESULT OF CLOUD SEEDING EXPERIMENT AT DELHI AS ASSESSED BY RADAR,
Inst. of Tropical Meteorology, Poona (India).
For primary bibliographic entry see Field 03B.
W70-01876

THE DIFFERENCE BETWEEN RAINFALL AND POTENTIAL EVAPORATION IN FLORIDA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02D.
W70-01881

A STUDY OF CLIMATOLOGICAL AND OTHER RAINFALL PATTERNS OVER CENTRAL INDIA,
Regional Meteorological Center, Nagpur (India).
V. C. Bedekar, and A. K. Banerjee.
Indian J Meteorol and Geophys, Vol 20, No 1, p 23-30, Jan 1969. 8 p, 8 fig, 4 ref.

Descriptors: *Climates, *Rainfall, *Rain, *Rainfall disposition, Seasonal, Monsoons, Forecasting, Altitude, Rain gages, Instrumentation, Mapping, Streamflow, Distribution patterns.
Identifiers: *Central India.

A study of rainfall patterns in central India consists of the normal monthly rainfall charts during the monsoon months for the Madhya Pradesh and Vidarbha areas; the spatial distribution of rainfall associated with monsoon depressions moving across Central India; and the character of rainfall at different places in and around a low-level convergence zone occurring over the above area. The use of self-recording raingage charts for local forecasting is also discussed. (Gabriel-USGS)
W70-01887

A PILOT STUDY FOR THE ESTIMATION OF PROBABLE MAXIMUM PRECIPITATION USING HERSHFIELD TECHNIQUE,
Institute of Tropical Meteorology, Poona (India).
O. N. Dhar, and P. P. Kamte.
Indian J of Meteorol and Geophys, Vol 20, No 1, p 31-34, Jan 1969. 4 p, 1 fig, 3 tab, 6 ref.

Descriptors: *Probable maximum precipitation, *Precipitation intensity, *Analytical techniques, Statistical methods, Probability, Rainfall, Frequency, Gaging stations, Mapping, Meteorological data.
Identifiers: *India, Uttar Pradesh.

A statistical technique developed by D. M. Hershfield (1961) is applied for the determination of one-day probable maximum precipitation for the plain areas of Uttar Pradesh using daily rainfall data from 230 stations. A generalized chart of probable maximum precipitation (PMP) based on these recorded data shows that in this region one-day PMP values obtained by this technique are 2 to 4 times the highest observed one-day rainfall during the past 60 to 70 years. (Gabriel-USGS)
W70-01888

MAJOR TEMPERATURE CHARACTERISTICS OF WATER IN THE WEST-CENTRAL PART OF THE CASPIAN SEA (IN AZERBAIDZHAN),
T. Kh. Zulfugarov.
Summary in Russian. Izvestiya Akademii Nauk, Azerbaidzhanskoi, SSSR, Seriya Fiziki Zemli, No 6, p 91-96, 1968. 2 fig, 2 tab, 4 ref.

Descriptors: *Surface waters, *Water temperature, *Seashores, *Sea water, Gaging stations, Hydrologic data, Meteorological data, Seasonal, Ice, Icebergs.
Identifiers: *USSR, Caspian Sea.

A brief history of investigations on the effect of various hydrometeorological parameters on sea water temperature and on the mean annual and monthly temperature values at several hydrometeorological stations is presented. The mean annual water temperature in the western and southern parts of the Central Caspian Sea is 12.5-12.6 deg C and 14.8-15.0 deg C respectively. Dur-

ing cold periods the water temperature difference is 415 deg and during the warm periods this difference does not exceed 1 to 2 deg. Effect of ice and icebergs on the water temperature is disscussed. (Gabriel-USGS)
W70-01910

2C. Snow, Ice, and Frost

GLACIER DRAINAGE CONNECTED WITH ICE STRUCTURES,
Uppsala Univ. (Sweden). Dept. of Physical Geography.
Thorsten Stenborg.
Geogr Ann, Vol 50, No 1, Ser A, p 25-53, 1968. 29 p, 22 fig, 7 tab, 60 ref.

Descriptors: *Runoff, *Glaciers, *Drainage, Ablation, Melting, Ice, Karst, Sediments, Melt water, Regimen.
Identifiers: *Sweden, *Mikkaglaciaren, Glacial drainage, Ice structures.

Systematic observations on Mikkaglaciaren in northern Sweden are presented and a general discussion is given concerning drainage connected with structures in the upper layer of a glacier. The basic conditions (surface drainage and structural pattern) for this drainage are first analyzed. A series of observations on 'drainage structures' during a five-year period is presented and reproduced on a map. Descriptions and comments are given as to the formation and further development of observed glacier mills and related features, with regard to local environmental characteristics and to the time factor involved. (Knapp-USGS)
W70-01702

2D. Evaporation and Transpiration

THE PREDICTION OF EVAPORATION, DRAINAGE, AND SOIL WATER STORAGE FOR A BARE SOIL,
Wisconsin Univ., Madison. Dept. of Soil Sciences.
For primary bibliographic entry see Field 02G.
W70-01664

EVAPORATION COEFFICIENT OF LIQUIDS,
Rochester Inst. of Tech., N.Y.
For primary bibliographic entry see Field 03A.
W70-01759

EVAPORATION FROM BARE SOIL UNDER HIGH RADIATION CONDITIONS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
C. W. Rose.
9th International Congress of Soil Science, Adelaide, Australia, 1968, Transactions, Vol 1, p 57-66. 10 p, 1 tab, 12 ref.

Descriptors: *Evaporation, *Solar radiation, *Arid lands, *Meteorological data, *Soil water movement, Energy budget, Soil water, Temperature, Soil temperature, Soil profiles, Soil physical properties, Moisture content, Equations.
Identifiers: *Australia, *Vapor flux, *Water transport, Vapor phase, Liquid phase.

The theory of Penman or Ferguson for predicting rate of evaporation from meteorological data is completely inapplicable when evaporation is limited by water transport in soil. Such conditions are common in arid lands with high levels of radiation. This paper presents a theory that enables evaporation from bare soil to be calculated from water content and temperature profiles. The theory was tested on an experimental site near Alice Springs, Australia. Evaporation over any time period is equated to the sum of upward liquid and vapor phase water fluxes at any depth in the soil and decrease in water stored in soil to that depth over the same interval. Vapor phase transport was found to be very important under conditions of bare soil and high evaporative potential. (Crouse-Arizona)
W70-01818

MOISTURE CONDENSATION ON WINTER VEGETATION,
Arizona Univ., Tucson. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02I.
W70-01835

THE DIFFERENCE BETWEEN RAINFALL AND POTENTIAL EVAPORATION IN FLORIDA,
Geological Survey, Washington, D.C.
F. N. Visher, and G. H. Hughes.
Florida Dep Natur Resources, Bur Geol Map Ser No 32, Aug 1969. 1 sheet, 1 fig, text, 1 map, 5 ref.

Descriptors: *Rainfall-runoff relationships, *Evaporation, *Florida, Hydrologic budget, Water balance, Climatology, Synoptic analysis, Regional analysis, Streamflow, Streamflow forecasting, Hydrologic data.
Identifiers: Evaporation-rainfall relationships (Fla).

Rainfall-potential evaporation differences in Florida are computed and shown by a contour map. The areal distribution of potential evaporation was taken from published sources. Rainfall data were compiled from U.S. weather Bureau records. Average rainfall ranges from about 46-66 inches annually, and estimated evaporation ranges from about 54-46 inches. The difference between rainfall and evaporation ranges from about 18 inches in the northwest to about zero in the southwest. (Knapp-USGS)
W70-01881

2E. Streamflow and Runoff

YIELD OF STREAMS IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
G. R. Higgins.
Mass Univ Water Resources Res Center Interim Rep, Mar 1967. 175 p, 14 fig, 4 tab, 20 ref, 4 append. OWRR Proj No A-003-MASS.

Descriptors: *Water yield, *Streamflow, *Massachusetts, *Hydrologic data, *Data collections, Droughts, Runoff, Hydrographs, Duration curves, Frequency analysis, Water storage, Climates, Precipitation (Atmospheric).
Identifiers: Storage-yield curves.

Results of studies on the yield of gaged streams in Massachusetts are summarized. Additional material includes introduction of computer methods for determining yield values and extension of the data. Data and comments concerning the recent drought in the Northeast and description of current research projects are introduced. A discussion of results to date and recommendations for future studies are also included. Runoff for the last five years has been extremely low and there are many who feel that the current drought is one of very rare occurrence. Design data including these years may be unrealistic. (Knapp-USGS)
W70-01700

THE RECENT HISTORY OF THE INDUS,
Hunting Technical Services Ltd., Boreham Wood (England).
For primary bibliographic entry see Field 07B.
W70-01804

BLUEPRINT FOR A PHYSICALLY-BASED, DIGITALLY-SIMULATED HYDROLOGIC RESPONSE MODEL,
Department of Energy, Mines and Resources, Calgary (Alberta). Inland Waters Branch; and Department of Fisheries and Forestry, Calgary (Alberta). Forestry Branch.
For primary bibliographic entry see Field 02A.
W70-01878

SEASONAL VARIATION OF STREAMFLOW IN FLORIDA,
Geological Survey, Washington, D.C.
W. E. Kenner.
Florida Dep Natur Resources, Bur Geol Map Ser No 31, July 1969. 1 sheet, 2 fig, 1 map.

Descriptors: *Streamflow, *Regional analysis, *Climatology, *Florida, Climatic data, Hydrologic data, Runoff, Rainfall-runoff relationships, Base flow, Aquifers, Rainfall, Seasonal, Wet seasons.
Identifiers: Seasonal streamflow variation (Fla).

Data on the seasonal variation of streamflow of 10 Florida rivers are compiled and shown by graphs. Florida's pattern of streamflow variation is unusual in two respects. First, the month-to-month variation in average streamflow is relatively small; second, the seasonal variations of streams in different sections of the state are different. The small month-to-month variability in streamflow is the result of (1) the relatively low variability of average monthly rainfall; (2) the relatively high rate of evapotranspiration in the summer; (3) the large volume of slowly released natural storage in Florida's numerous lakes; and (4) the large and relatively stable inflow of groundwater to streams from extensive limestone and alluvial aquifer systems. Florida's unusual pattern of seasonal variation of streamflow is due largely to its position in the transition zone between the continental weather pattern of southeastern United States and the tropical weather pattern of the Caribbean Sea. During the winter and early spring the continental pattern predominates in northern Florida. Florida's summer and fall climate is sub-tropical and is characterized by local thunderstorms. The line of demarcation between areas dominated by the two weather types is not sharp. The continual north-south shifting of the tropical and continental air masses results in a seasonal distribution of rainfall that has a predominantly continental pattern in northwestern Florida, is less continental and more tropical in central Florida, and is predominantly tropical in southern Florida. (Knapp-USGS)
W70-01880

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 6. MISSOURI RIVER BASIN.
Geological Survey, Washington, D.C.

Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402. Geol Surv Water-Supply Pap 1919, 1969. 805 p, 1 fig, 1 plate, index.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Missouri River, *Nebraska, Missouri, Kansas, Colorado, Iowa, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Water temperature.
Identifiers: Surface water records, Water resources data, Missouri River Basin.

The surface-water records for the 1961-65 water years for gaging stations, partial-record stations, and miscellaneous sites in the Missouri River basin are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the

types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed in a table. (Knapp-USGS)
W70-01884

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 6. MISSOURI RIVER BASIN.
Geological Survey, Washington, D.C.

Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402. Geol Surv Water-Supply Pap 1918, 1969. 751 p, 1 fig, 1 plate, index.

Descriptors: *Data collections, *Surface waters, *Streamflow, Hydrologic data, Missouri River, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Discharge (Water).
Identifiers: *Surface water records, *Missouri River basin, Water resources data.

The surface-water records for the water years 1961-65 for gaging stations, partial-record stations, and miscellaneous sites in the Missouri River basin are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed in a table. (Knapp-USGS)
W70-01885

NATIONAL INVENTORY OF SURFACE WATER RESOURCES - VOLUME 1,
Ministry of Public Works, Caracas (Venezuela).
Alfredo Lopez.
Repub of Venezuela, Comm for Nat Plan of Water Develop Spec Publication, Feb 1969. 34 p, 3 tab, 6 ref, append.

Descriptors: *Data collections, *Hydrologic data, *Surface waters, *Surveys, Runoff, Streamflow, Precipitation (Atmospheric), Water resources development, Climates, Hydrography.
Identifiers: *Venezuela, Surface water inventory.

An inventory of the surface water resources data of Venezuela includes information on streamflow, water quality, and water availability. A mean annual isohyetal map, a mean annual isothermic map, a nationwide estimate of evapotranspiration, and mean national runoff volume were prepared. Regional mean annual runoff values are tabulated. Major rivers and their annual flows are listed. (Knapp-USGS)
W70-01889

A STUDY OF THE PHYSICAL HYDROGRAPHY OF THE PATUXENT RIVER AND ITS ESTUARY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W70-01890

AERIAL INFRARED SURVEYS AT THE GEYSERS GEOTHERMAL STEAM FIELD, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W70-01894

DRAINAGE DENSITY AS AN INDICATOR OF BASE FLOW IN PART OF THE POTOMAC RIVER BASIN,
Geological Survey, Washington, D.C.
Frank W. Trainer.
In: Geol Surv Res 1969, Prof Pap 650-C, p C177-C183, 1969. 7 p, 4 fig, 2 tab, 11 ref.

Descriptors: *Base flow, *Drainage density, Runoff, Streamflow, Hydrographs, Hydrograph analysis, Stream gages, Streamflow forecasting, Hydrogeology, Mapping.
Identifiers: Drainage density-base flow relations.

The base flow from 10 stream basins in an area of 1,900 square miles in the Piedmont and Blue Ridge provinces in Pennsylvania, Maryland, and Virginia, as determined by hydrograph separation, is inversely proportional to drainage density. This relationship was used to estimate the base flow from ungaged basins in the area. Streamflow records from two gages on the Potomac River, also studied by hydrograph separation, define the contribution of the entire area to the discharge of the river and provide a check on the estimate made by drainage density. For a 1-year period the estimate of base flow from the ungaged basins, made by the use of drainage density, is within 45% of the estimate from hydrograph separation. This agreement suggests that drainage density will be useful in hydrogeologic mapping and in planning streamflow measurements for the study of base flow. (Knapp-USGS)
W70-01896

2F. Groundwater

ARTIFICIAL RECHARGE TO THE SNAKE PLAIN AQUIFER IN IDAHO; AN EVALUATION OF POTENTIAL AND EFFECT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W70-01654

GEOLOGICAL AND HYDROGEOLOGICAL RESEARCH IN THE WESTERN PART OF THE GETIC DEPRESSION (RUMANIAN),
Emil Liteanu, Mircea Feru, Mihai Croitoru, Natalia Golita, and Eugen Golita.
Studii Tehnice si Economice, Seria E, Hidrogeologie, No 7, Studii de Hidrogeologie, p 7-58, 1967. 4 fig, 6 tab, 39 ref. Summaries in English and French.

Descriptors: *Hydrogeology, *Aquifers, *Hydrologic properties, Geology, Boreholes, Artesian wells, Water supply, Coals, Hydrostatic pressure, Altitude, Discharge (Water), Water sources, Chemical analysis.
Identifiers: Rumania, Getic depression.

Geological and hydrological conditions of the Getic depression were investigated by using geological, geochemical, and hydrological observations. The surface rocks of the depression are of Pliocene and Quaternary age. Several aquifers separated by coal beds are under pressure varying from 3.7 to 1.2 atm. It is believed that these artesian aquifers are well suited for agricultural or industrial uses. (Gabriel-USGS)
W70-01655

ARTIFICIAL GROUNDWATER RECHARGE - WET WALNUT CREEK,
Geological Survey, Lawrence, Kans. Water Resources Div.; and Kansas Water Resources Board, Topeka.
For primary bibliographic entry see Field 04B.
W70-01659

GEOLOGY AND GROUND WATER RESOURCES OF BURKE AND MOUNTRAIL COUNTIES: PART 2, GROUND WATER BASIC DATA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W70-01684

GEOLOGY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA: PART 3 - HYDROLOGY,
Geological Survey, Washington, D.C.
C. A. Armstrong.
N Dak Geol Surv Bull 48 and N Dak State Water Comm County Ground Water Studies 9, 1969. 82 p, 22 fig, 2 plate, 2 tab, 34 ref.

Descriptors: *Water resources, *Groundwater, *North Dakota water wells, Hydrologic data, Data collections, Aquifers, Water quality, Water yield, Water levels, Water Supply, Recharge, Permeability.
Identifiers: *Williams County (N Dak).

Groundwater in Williams County, North Dakota, is obtained from aquifers in the glacial drift of Quaternary age, the Fort Union Group of Tertiary age, and the Dakota Group of Cretaceous age. Three of the more productive aquifers are the Little Muddy, Ray, and Grenora; these aquifers are composed of sand and gravel that was deposited in the ancestral Yellowstone, Little Missouri, and Missouri River valleys, respectively. Properly constructed wells in the more permeable parts of these glacial aquifers can be expected to yield more than 500 gallons per minute. Yields of more than 500 gpm are also obtainable from the more permeable parts of the Trenton and Hofflund aquifers in the proglacial Yellowstone and Missouri River valleys. Yields of 50 to 500 gpm are obtainable from some outwash and buried glaciofluvial deposits in the northern part of the county and from some of the finer sand deposits in the 5 major aquifers. Water from the glacial drift aquifers differs greatly in quality. Generally it is very hard and of a calcium bicarbonate type. Water in the Fort Union Group consists of 2 types; a soft sodium bicarbonate water, and a hard sodium sulfate bicarbonate water. Generally it is too saline for human consumption or irrigation. Water from the Dakota is used for pressure maintenance in oil fields, but is too saline for most other uses. (Knapp-USGS)
W70-01685

OBSERVATIONS OF THE PRESSURE SURFACE IN THE AQUIFER OF AN IRRIGATION DISTRICT AT MERBEIN, AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Merbein (Victoria). Div. of Horticultural Research.
J. Groot Obbink.
J Hydrol, Vol 9, No 3, p 294-306, Nov 1969. 13 p, 6 fig, 3 tab, 8 ref.

Descriptors: *Water levels, *Aquifers, *Irrigated land, *Irrigation effects, Water level fluctuations, Saturated soils, Water table, Groundwater movement, Piezometers, Hydrogeology, Sands.
Identifiers: *Australia, Merbein (Victoria).

To observe the pressure surface in the aquifer in the Merbein Irrigation District, which is situated on the River Murray in Northwest Victoria, one piezometer was installed in 1952 and a further nine piezometers were installed in 1960. The aquifer is a Post-Tertiary water bearing sand located at depths ranging from 14 to 75 ft from the surface. The bedrock, consisting of paleozoic rock, is estimated to be about one thousand feet below the soil surface. Location of piezometers and depth of the aquifer below soil surface at each piezometer site are given. Information obtained over a period of eight years has shown that the pressure surface is not constant but in general has risen, although at different rates for each piezometer site. The increases ranged from 0.35 ft to 2.49 ft, while one piezometer site has shown a decrease of 1.25 ft. The pressure surface in the piezometer installed in 1952 has risen by 5.29 ft over a period of 15 years. The rise of pressure surface, the direction of flow, the quality of the water in the aquifer and the potential danger for certain low-lying areas are discussed. (Knapp-USGS)
W70-01857

THE USE OF SCHLUMBERGER AND EQUATORIAL SOUNDINGS IN GROUNDWATER INVESTIGATIONS NEAR EL PASO, TEXAS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W70-01859

BLUEPRINT FOR A PHYSICALLY-BASED, DIGITALLY-SIMULATED HYDROLOGIC RESPONSE MODEL,
Department of Energy, Mines and Resources, Calgary (Alberta). Inland Waters Branch; and Department of Fisheries and Forestry, Calgary (Alberta). Forestry Branch.
For primary bibliographic entry see Field 02A.
W70-01878

BASE FLOW WELLS: RIO COBRE PROJECT, JAMAICA,
Humphreys (Howard) and Sons, Reading (England); and Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 04B.
W70-01891

GROUND-WATER INFLOW TOWARD JORDAN VALLEY THROUGH CHANNEL FILL IN SEVEN CANYONS IN THE WASATCH RANGE NEAR SALT LAKE CITY, UTAH,
Geological Survey, Salt Lake City, Utah.
R. W. Mower.
In: Geol Surv Res 1969, Prof Pap 650-C, p C174-C176, 1969. 3 p, 2 fig, 1 tab, 4 ref.

Descriptors: *Groundwater movement, *Inflow, *Alluvium, *Alluvial channels, *Utah, Hydraulic conductivity, Transmissivity, Recharge, Discharge (Water), Water levels, Water table, Underflow, Groundwater basins.
Identifiers: Wasatch Range, Salt Lake City (Utah).

The estimated quantity of underflow moving toward the Jordan Valley in the channel fill of 7 major canyons in the Wasatch Range near Salt Lake City, Utah, is 3,400 acre-feet of water per year. About 2,000 acre-feet of this water is discharged by springs and wells before it reaches the principal groundwater reservoir in the valley, leaving about 1,400 acre-feet per year available for recharge. About 93% of the recharge is from Little Cottonwood Creek Canyon and 7% from the other 6 canyons. (Knapp-USGS)
W70-01895

HYDROGEOLOGIC RECONNAISSANCE OF THE CANARY ISLANDS, SPAIN,
Geological Survey, Lawrence, Kan.; and Ministry of Public Works (Canary Islands).
Robert J. Dingman, and Jose Nunez.
In: Geol Surv Res 1969, Prof Pap 650-C, p C201-C208, 1969. 8 p, 3 fig, 3 tab, 7 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Water resources development, *Surveys, Hydrogeology, Water wells, Water yield, Aquifers, Water levels, Water level fluctuations.
Identifiers: Canary Islands.

The Canary Islands are a group of volcanic islands off the west coast of Africa. Rainfall is sparse, and groundwater is used to support an agricultural economy. On the major islands overpumpage occurs and water levels are lowering rapidly. (Knapp-USGS)
W70-01901

CARBON-14 DATES OF GROUND WATER FROM A PALEOZOIC CARBONATE AQUIFER, SOUTH-CENTRAL NEVADA,
Geological Survey, Denver, Colo.; and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W70-01903

GEOCHEMISTRY OF IRON IN A COASTAL-PLAIN GROUND WATER OF THE CAMDEN, NEW JERSEY, AREA,
Geological Survey, Trenton, N.J.
For primary bibliographic entry see Field 02K.
W70-01905

GEOLOGICAL AND HYDROGEOLOGICAL OBSERVATIONS IN THE TIRGUL SECUIESC ZONE (ROMANIAN),
Bucharest Inst. of Geology (Rumania).
T. Bandrabur.
Summaries in English and French, Romania, Institutul Geologic, Studii Tehnice si Economice, Seria E, Hidrogeologie No 7, Studii de Hidrogeologie, p 87-103, 1967. 1 fig, 2 tab, 13 ref.

Descriptors: *Water chemistry, *Hydrogeology, *Geology, *Aquifers, Quaternary period, River basins, Water analysis, Chlorine, Sodium, Calcium, Magnesium, Carbonates, Sulfates, Water quality.
Identifiers: *Romania, Tirgul Secuiesc Zone.

Hydrogeology and morphology of the Tirgul Secuiesc Zone, Romania was investigated on the basis of hydrogeological and geochemical studies. Groundwaters of the zone are characterized by mineral contents of 0.450 to 1.600 gr/Kg; however some highly mineralized waters have 2.0-6.0 gr/Kg contents. Fresh water as well as the mineralized waters of the zone belong to five hydrochemical groups as follows: calcium-magnesium bicarbonates; sodium-carbon dioxide-bicarbonates; calcium-chlorine bicarbonates; calcium sulfates; and calcium chlorides. (Gabriel-USGS)
W70-01906

HYDROGEOLOGICAL RESEARCH IN THE DANUBE DELTA (ROMANIAN),
State Geological Committee, Bucharest (Rumania).
E. Liteanu, A. Pricajan, and Maria Mocanu.
Summaries in English and French, Romania Institutul Geologic, Studii Tehnice si Economice, Seria E, Hidrogeologie No 7, Studii de Hidrogeologie, p 59-86, 1967. 1 fig, 3 plate, 7 tab, 8 ref.

Descriptors: *Hydrogeology, *Aquifers, *Deltas, Geology, Quaternary period, Salinity, Underground streams, Discharge (Water), Potable water, Paleozoic era, Mesozoic era, Water chemistry, Calcium, Magnesium, Iron, Chlorine, Ions.
Identifiers: Danube delta.

The presence and distribution of aquifers in the Danube delta was investigated on the basis of geological, hydrological, and geochemical data. Water bearing strata can be found in both the Quaternary basement and deltaic sediments. The aquifers of the basement formations generally have a high mineral content and are of no practical value. The deltaic deposits are characterized by the presence of groundwater flows and can be well utilized, especially the western zone where good drinking water of high discharge is observed. Groundwaters located in the marine delta zone cannot be utilized because of their high salinity content. (Gabriel-USGS)
W70-01907

ORIGIN OF THE MINERALIZATION OF THE PHREATIC WATERS IN THE BUZAU-RIMNICUL SARAT INTERFLUVIAL PLAIN (ROMANIAN),
Babes-Bolyai Univ., Cluj (Rumania).
P. Marosi.
English summary. Romania Institutul Geologic, Studii Tehnice si Economice, Seria E, Hidrogeologie, No 7, Studii de Hidrogeologie, p 105-147, 1967. 8 fig, 8 plate, 4 tab, 33 ref.

Descriptors: *Hydeogeology, *Aquifers, *Mineral water, Climates, Dry seasons, Salinity, Geology, Streamflow, River basins, Water chemistry, Water analysis, Ions, Iron, Sodium, Calcium, Magnesium, Potassium, Sulfates.
Identifiers: *Romania, Buzau-Rimnicul Sarat.

The hydrogeology and hydrochemistry of the Buzau-Rimnicul Sarat area, Romania are discussed. The position of phreatic waters corresponds to the law of hydrogeological zones characterized by the piemontane accumulative structures where, under the effect of dry climate, the hydrochemical zone of the phreatic waters is formed due to the effect of continental salinization processes. The position and the salinity zone of the phreatic water are affected to a large extent by the waters of the Rimnicul Sarat River which penetrates the phreatic horizon. The study separates the area into several districts characterized by their peculiar mineralization, such as phreatic, fluvial, lacustrine, etc. (Gabriel-USGS)
W70-01908

HYDROGEOLOGICAL RESEARCH IN THE BARAOLT BASIN (ROMANIAN),
Gh. Vasilescu, and Neonila Avramescu.
French summary. Romania, Institutul Geologic, Studii Tehnice si Economice, Seria E, Hidrogeologie, No 7, Studii de Hidrogeologie, p 151-171, 1967. 3 plate, 1 tab, 4 ref.

Descriptors: *Hydrogeology, *River basins, *Aquifers, Boreholes, Wells, Pumping, Water supply, Water storage, Drainage water, Porosity, Permeability, Infiltration, Carbon dioxide, Methane, Coals.
Identifiers: *Romania, Baraolt basin.

To evaluate the hydrogeological conditions of the coal deposits of the Baraolt basin, the water-bearing strata of the basin were investigated down to a depth of 150 feet. Analysis of the experimental pumping well data shows that the amount of water discharge is a function of the horizon permeability and grain size. Carbon dioxide and weak emanations of methane gas are present in the aquifers, with the carbon dioxide content somewhat increasing with depth. Hydrological conditions of the coal deposits are of a very difficult and complicated nature. (Gabriel-USGS)
W70-01909

HYDROGEOLOGIC STUDY OF MAMORA, (FRENCH),
Morocco Geological Service, Rabat.
For primary bibliographic entry see Field 02A.
W70-01911

2G. Water in Soils

RELATIONSHIPS AMONG ADSORBED PHOSPHATE, SILICA, AND HYDROXYL DURING DRYING AND REWETTING OF KAOLINITE SUSPENSION,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agricultural Research; and Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 02K.
W70-01645

REACTIONS OF Ce IN SOLUTION AND SUSPENSIONS OF SOIL HUMIC ACID AND BENTONITE,
Ohio Agricultural Research and Development Center, Wooster; and Ohio State Univ., Columbus.
For primary bibliographic entry see Field 02K.
W70-01646

ADSORPTION OF NITRATE IN AMORPHOUS AND KAOLINITIC HAWAIIAN SOILS,
Hawaii Univ., Honolulu. Dept. of Soil Science.
For primary bibliographic entry see Field 02K.
W70-01647

PROPERTIES OF SOME SOILS IN THE CUMBERLAND PLATEAU AS RELATED TO SLOPE ASPECT AND POSITION,
Soil Conservation Service, Beltsville, Md.; Soil Conservation, Knoxville, Tenn.; and Forest Service (USDA), Somerset, Ky.

D. P. Franzmeier, E. J. Pedersen, T. J. Longwell, J. G. Byrne, and C. K. Losche.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 755-761, Sept-Oct 1969. 7 p, 3 fig, 7 tab, 12 ref.

Descriptors: *Soils, *Slopes, *Soil physical properties, *Soil chemical properties, *Geomorphology, Soil temperature, Soil moisture, Soil horizons, Storage capacity.
Identifiers: Soils of Kentucky, Soils of Tennessee, Base saturation, Slope aspect, Topography-soil formation relations.

Soils developed from acid siltstones and shales were sampled on the lower, middle, and upper part of steep north and south-facing slopes in transects made across ridges in eastern Kentucky and Tennessee. Particle size distribution, base saturation, and soil temperature are related to slope position. Soils in the middle slope positions are higher in coarse material than those in the upper or lower positions. Soils in the lower slope positions have the highest base status and are coolest. Slope aspect influences soil temperature and organic matter content and the kinds of horizons formed and their color. Most soils on the south-facing slopes have argillic horizons while most on the north-facing slopes have cambic horizons. Soils on the north slope have almost 2C lower mean annual temperature, contain more organic matter, are darker in color, and hold more water during a period of water stress than soils on the south-facing slope. (Carstea-USGS)
W70-01649

INFILTRATION AND WATER DEPLETION IN LYSIMETERS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
Hasan K. Qashu.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 775-778, Sept-Oct 1969. 4 p, 3 fig, 6 ref.

Descriptors: *Lysimeters, *Water loss, *Infiltration, *Rainfall-runoff relationships, *Evapotranspiration, Forecasting, Moisture content, Water balance, Runoff, Soil water movement, Soil physical properties, Soil moisture, Vegetation effects.
Identifiers: Evapotranspiration forecasting.

Evapotranspiration losses from five lysimeters with different plant species were estimated. Prediction equations were developed and used to estimate soil water regimens, infiltration, and runoff in lysimeters with vegetative cover. Calculated soil water contents and runoff for lysimeters with 5 different plant species were good estimates of measured quantities. Water balance elements from tree-, brush-, and grass-covered soils showed variabilities between species and for total season precipitation. It is concluded that the presented procedure of estimating the elements of water balance is useful in areas with limited data. But for a physical explanation of the cause and effects in surface water/soil water continua, hydrologic relations must be sought through mathematical analysis of a time-varying system. Derived equations for estimating soil water depletion and infiltration predictors are very useful first approximations for the evaluation of 2 elements-- runoff and water storage--in the hydrologic cycle. They reveal the importance of vegetation, specifically plant species, as a principal component in the rainfall-runoff process. (Carstea-USGS)
W70-01650

EFFECTS OF PETROLEUM MULCH ON SOIL WATER CONTENT AND SOIL TEMPERATURE,
Oregon State Univ., Corvallis. Dept. of Soils.
Ahang Kowsar, L. Boersma, and G. D. Jarman.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 783-786, Sept-Oct 1969. 4 p, 6 fig, 1 tab, 14 ref. OWRR Proj B-001-ORE.

Descriptors: *Soil management, *Mulching, *Soil moisture, *Soil temperature, Evaporation control, Soil conservation, Infrared radiation, Soil physical properties, Water loss, Storage capacity, Soil water movement.
Identifiers: Petroleum mulch.

Soil temperature and soil water content were measured at 2-hour intervals in mulched and unmulched chehalis silty clay loam subjected to a diurnal temperature cycle. At the time the soil temperatures attained their maximum value at a depth of 1 cm, the mulch-covered soil was 5C warmer than the bare soil; at all other times the difference in temperature between bare and mulched soil was smaller. In the upper 1 cm of mulched soil, water was lost but the soil gained water at depths where seedlings are normally placed. It was concluded that the petroleum mulch improved soil water and soil temperature conditions. (Carstea-USGS)
W70-01651

RESOLVING TIME, MASS ABSORPTION COEFFICIENT AND WATER CONTENT WITH GAMMA-RAY ATTENUATION,
Iowa State Univ., Ames.
D. D. Fritton.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 651-655, Sept-Oct 1969. 5 p, 1 fig, 4 tab, 8 ref. AEC OWRR Proj A-003-IA.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, *Calibrations, *Gamma rays, *Soil moisture, Analytical techniques, Soil physical properties, Instrumentation, Soil types, Soil texture, Absorption, Moisture content.
Identifiers: *Resolving time, Mass absorption coefficient, Gamma-ray attenuation, Gamma-ray scattering, Gamma-ray calibration, Gamma-ray intensity correction.

An intensity correction for gamma-ray attenuation is determined by using the minute nonlinearity of a semi-log plot of gamma-ray intensity versus the thickness or the product of thickness and density of a material. The experimentally determined correction is expressed in terms of resolving time and varied with both material and counting rate. A correction of 5.0 microseconds/count was determined experimentally as the best resolving time to correct the observed counting rates for water content determination. Part of the correction was evidently due to causes other than resolving time. Mass absorption coefficients of water and soil were 0.08105 and 0.07309 sq cm, respectively, with no correction and were 0.0871 and 0.0773 sq cm with a 5.0 microsecond/count correction. The difference between gravimetric water content and gamma-ray water content dropped from 3.02% to 0.60% when this correction was used. (Carstea-USGS)
W70-01652

EVALUATING THE USE OF Na, Ca, AND DIVALENT CATION ELECTRODES IN SOME SOIL EXTRACTING SOLUTIONS,
Hawaii Inst. of Geophysics, Honolulu.
S. A. El-Swaify, and M. N. Gazdar.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 665-667, Sept-Oct 1969. 3 p, 3 fig, 2 tab, 17 ref. Contract No 14-01-0001-673 (Office of Saline Water).

Descriptors: *Electrodes, *Chemical potential, *Ions, *Calibrations, Calcium, Magnesium, Salts, Aqueous solutions, Analytical techniques, Instrumentation, Spectrophotometry, Colorimetry, Membranes, Sodium, Soil moisture.
Identifiers: Activity, Activity coefficient.

The performances of sodium activity, calcium activity, and divalent cation activity electrodes were determined and compared with predicted theoretical responses in unbuffered systems and in buffered systems at concentrations of 0.2 m, 0.5 m, and 1.0 m. In support of previous findings on a less selective sodium electrode, results show that the Na-electrode exhibits a response which is nearly Nernstian, allowing good estimates of Na ion activities in soil extracts. In contrast, the usefulness of the calcium and divalent-electrodes in buffered systems (and subsequent usefulness for determining exchangeable ions) was found to be limited particularly at high levels of total salt concentration. Although better response was observed for these two electrodes in unbuffered systems, the determination of Ca and Mg in water-soil extracts by their combined use is limited by the apparent reversibility of the calcium electrode to Mg ions present in calcium-magnesium salt mixtures. (Carstea-USGS)
W70-01653

PROFILE MODIFICATIONS OF A SLOWLY PERMEABLE SOIL,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
H. V. Eck, and H. M. Taylor.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 779-783, Sept-Oct 1969. 5 p, 3 fig, 5 tab, 9 ref.

Descriptors: *Soil profiles, *Permeability, *Irrigation, *Cultivation, Soil types, Soil texture, Storage capacity, Water conservation, Soil physical properties, Soil water, Soil water movement, Productivity, Deep tillage, Texas.
Identifiers: Southwestern Great Plains Research Center, Soil profile modification, Water use efficiency.

Soil profile modification was studied in a Pullman silty clay loam at the Sothwestern Great Plains Research Center, Bushland, Texas. Three depths of profile modification (0, 90, and 150 cm) were studied under two water levels (preplant irrigation and full irrigation). Grain sorghum yields increased by 66.2 and 80.1% under limited water conditions when the profiles were modified to depths of 90 and 150 cm, respectively. Changes in amount and distribution of stored water and in rooting patterns resulted in the increased yields. Water use efficiency was increased under adequate irrigation, but there was little effect on total yields. (Carstea-USGS)
W70-01656

CONDUCTIVITY INSTRUMENTATION FOR IN SITU MEASUREMENT OF SOIL SALINITY,
Burr-Brown Research Corp., Tucson, Ariz.; and Arizona Univ., Tucson.
C. G. Enfield, and D. D. Evans.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 787-789, Sept-Oct 1969. 3 p, 8 fig, 1 tab, 5 ref.

Descriptors: *Electrical conductance, *Instrumentation, *Salinity, *Soil chemical properties, Soil physical properties, Soil temperature, Aqueous solutions.
Identifiers: Soil salinity meters.

A transducer has been developed which is capable of assessing, in situ, the electrical conductivity of soil water. The transducer is constructed of porous glass with platinum electrodes and operates over the entire field moisture range. The transducer is accurate to within 10% when measured with an associated solid state meter in a conductivity range of 1-20 millimhos/cm at 25C and a temperature range of 5-45C. Typically, the time required to achieve 63% of equilibrium response, in aqueous solutions, is less than 2 hours. (Carstea-USGS)
W70-01657

RUNOFF INDUCEMENT IN AN ARID REGION BY REMOVAL OF VEGETATION,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
For primary bibliographic entry see Field 03B.
W70-01658

THE EFFECT OF DRYING ON SOIL STRENGTH PARAMETERS,
National Tillage Machinery Lab., Auburn, Ala.
C. R. Camp, and W. R. Gill.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 641-644, Sept-Oct 1969. 4 p, 3 fig, 1 tab, 12 ref.

Descriptors: *Drying, *Soil strength, *Soil physical properties, *Soil moisture, Cohesion, Shear strength, Water loss, Soil water movement, Bulk density, Soil types, Friction.
Identifiers: *Soil moisture-strength relationships, *Unsaturated media, Triaxial shear strength.

The influence of drying on the magnitudes of the cohesion and friction angle soil strength parameters was determined for three cohesive soils. Shear strength measurements were made using a modified laboratory triaxial apparatus for three different soil types on samples prepared in the laboratory. All samples of a given soil type were molded at the same soil water content and to the same bulk density. Samples were dried slowly to soil water contents between the 1/3-bar soil water suction level and air dryness. The criterion used to determine shear was either the development of a definite failure plane or an increase in sample diameter of 0.25 mm, whichever occurred first. Volume change of the sample and the applied axial and radial stresses were measured and recorded continuously throughout a test cycle. Mohr's circles were constructed and the soil strength parameters were determined for all samples. The parameters both increased with drying for these soils. (Carstea-USGS)
W70-01662

SOIL-WATER HYSTERESIS MEASURED IN A SANDY LOAM AND COMPARED WITH THE HYSTERIC DOMAIN MODEL,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
G. C. Topp.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 645-651, Sept-Oct 1969. 7 p, 8 fig, 1 tab, 17 ref.

Descriptors: *Soil water movement, *Hysteresis, *Model studies, *Soil moisture, *Soil physical properties, Soil texture, Gamma rays, Pressure head, Hydraulic conductivity, Instrumentation, Tensiometers, Drying, Wetting, Hydraulic models.
Identifiers: *Soil-water hysteresis, Sandy loam soil, Gamma ray attenuation.

A controlled series of wetting and drying changes was applied to a uniformly packed column of sandy loam soil. The relationships between soil water content, pressure head and hydraulic conductivity were determined in the laboratory. Gamma ray attenuation provided information regarding the soil water content. A pressure transducer was used to measure simultaneous tensiometer pressures at five locations along the soil column. Different levels in the column have been used to map out scanning curves suitable for quantitative tests of the independent domain theory of hysteresis. Analysis of the primary scanning curves showed that the independent domain theory of hysteresis is an inadequate model for both wetting and drying curves. No measurable hysteresis in the water content-hydraulic conductivity relationship was observed following consolidation during the initial drying phase. (Carstea-USGS)
W70-01663

THE PREDICTION OF EVAPORATION, DRAINAGE, AND SOIL WATER STORAGE FOR A BARE SOIL,
Wisconsin Univ., Madison. Dept. of Soil Sciences.
T. A. Black, W. R. Gardner, and G. W. Thurtell.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 655-660, Sept-Oct 1969. 6 p, 8 fig, 18 ref.

Descriptors: *Evaporation, *Drainage, *Water storage, *Soil water movement, Soil moisture, Soil conservation, Storage capacity, Forecasting, Irrigation, Water management (Applied), Drying, Rainfall, Lysimeters, Capillary conductivity, Diffusivity.
Identifiers: Plainfield sand soil.

Evaporation, drainage, and changes in storage for a bare Plainfield sand were measured with a lysimeter during June, July, and August 1967, under natural rainfall conditions. Cumulative evaporation at any stage was proportional to the square root of time following each heavy rainfall. The drainage rate was found to be an exponential function of water storage. Both relations can be predicted from flow theory with knowledge of soil capillary conductivity, diffusivity, and moisture retention characteristics. Using these two relations and daily rainfall data, the water storage in the top 150 cm was predicted over the season to within 0.3 cm. (Carstea-USGS)
W70-01664

STANDARD HEATS AND ENTROPIES OF EXCHANGE FOR ALKALI METAL CATIONS ON WYOMING BENTONITE,
UT-AEC Agricultural Research Lab., Oak Ridge, Tenn.; Louvain Univ. (Belgium). Inst. of Agronomy; and Fisk Univ., Nashville, Tenn.
For primary bibliographic entry see Field 02K.
W70-01665

THEORETICAL CONSIDERATION OF THE CALCIUM SULFATE-BICARBONATE-CARBONATE INTERRELATION IN SOIL SOLUTION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02K.
W70-01666

PROPERTIES OF VERMICULITES AND SMECTITES: EXPANSION AND COLLAPSE,
Oregon State Univ., Corvallis. Dept. of Soils.
M. E. Harward, D. D. Carstea, and A. H. Sayegh.
Clays and Minerals, Vol 16, p 437-447, 1969. 11 p, 4 fig, 7 tab, 20 ref.

Descriptors: *Analytical techniques, *Clay minerals, *Expansive clays, Moisture uptake, X-ray diffraction, Cation exchange, Beidellite, Bentonite, Montmorillonite, Mineralogy, Potassium, Calcium, Magnesium, Solvation.
Identifiers: Smectite, Vermiculite.

Samples of smectites and vermiculites were evaluated to (1) determine the effects of source and amount of charge; (2) determine if a continuum of properties exists, and (3) improve the basis for differentiating criteria for identification. The montmorillonites expanded to the equivalent two-layer complex upon solvation by condensation of ethylene glycol or glycerol vapor. Beidellite exhibited the one-layer complex with glycerol vapor and the two-layer complex with ethylene glycol. The vermiculite samples did not yield regular two-layer complexes regardless of saturating cation, prior moisture or solvating agent. A number of different complexes of vermiculite were obtained depending on conditions of solvation. Potassium-saturated vermiculites and smectites both exhibited collapsed layers in a dry atmosphere. Hydration of smectites occurred at humidities above 20% and resulted in poorly ordered diffraction maxima of 11-12 angstroms. The K-saturated vermiculites tended to retain the collapsed lattice and exhibited diffraction maxima of 10-10.6 angstroms with integral higher orders. Differences in properties can be related to both source and amount of charge. Nevertheless, a continuum in the properties of expansion and collapse between the smectites and vermiculites was not observed. The data indicate two discrete populations. (Carstea-USGS)
W70-01670

THE ESTIMATION AND OCCURRENCE OF AGRICULTURAL DROUGHT,
Department of Agriculture, Ashburton (New Zealand). Winchmore Irrigation Research Station.
For primary bibliographic entry see Field 03F.
W70-01687

SODIUM ADSORPTION RATIO INFLUENCE ON STABILIZATION POND SEALING,
South Dakota School of Mines and Technology, Rapid City. Dept. of Civil Engineering, and South Dakota State Univ., Brookings. Dept of Civil Engineering.
For primary bibliographic entry see Field 05D.
W70-01690

THE ACHIEVEMENTS OF DRAINAGE THEORY IN RELATION TO PRACTICAL NEEDS: TAKING STOCK,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
E. C. Childs.
9th International Congress of Soil Science, Adelaide, Australia, Transactions, Vol 1, 1968, p 349-356. 8 p, 23 ref.

Descriptors: *Drainage systems, *Soil physics, *Arid lands, *Irrigation, *Land reclamation, Agriculture, Soil properties, Agricultural engineering, Salinity, Hydraulic conductivity, Equations, Water table, Irrigation efficiency.
Identifiers: *U. A. R., Drainage Theory, Parameters.

Theoretical soil physics and laboratory research techniques have developed more rapidly in recent years than methods for field application. In the area of drainage problems the author proposes that emphasis be placed on development of practical methods of measurement of parameters relative to soil drainage so that the body of theory can be applied more effectively to agriculture. In arid lands where irrigation is the water source, empirical methods are probably adequate since the excess of water applied is predictable. Although a field manual for agriculturalists is not practical, a consultant well versed in theory can offer advice on large-scale problems that is superior to guess work based only on experience. An example is cited in the land reclamation project in the Lake Mariyut area on the north coast of the U. A. R. Drainage theory has made it possible to forecast here the level of a steady water table under irrigation within acceptable limits. (Crouse-Arizona)
W70-01817

EVAPORATION FROM BARE SOIL UNDER HIGH RADIATION CONDITIONS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
For primary bibliographic entry see Field 02D.
W70-01818

THE INFLUENCE OF SUBSURFACE ASPHALT BARRIERS ON THE WATER PROPERTIES AND THE PRODUCTIVITY OF SAND SOILS,
Michigan State Univ., East Lansing.
A. E. Erickson, C. M. Hansen, and A. J. M. Smucker.
9th International Congress of Soil Science, Adelaide, Australia, 1968, Transactions, Vol 1, p 331-337. 7 p, 4 tab, 1 fig.

Descriptors: *Arid lands, *Sands, *Impervious membranes, *Asphalt, *Barriers, Economic feasibility, Vegetable crops, Nuclear moisture meters, Arizona, Michigan, Soil-water-plant relationships, Soil properties, Root zone, Moisture tension, Drainage, Penetration.
Identifiers: *Taiwan, Formosa.

Field trials were made with placement of an impervious asphalt barrier at various depths in sandy soils in Michigan, Arizona, and Taiwan, Formosa. The barrier increases the amount of water held in the root zone of crops. Aerial extent of the barrier is determined by drainage requirements. Soil moisture measurements were made by the nuclear probe method in arid soils. The technique has made irrigation economically feasible for high value crops. (Crouse-Arizona)
W70-01819

THEORY AND EXPERIMENT IN CANAL SEEPAGE ESTIMATION USING RADIOISOTOPES,
Bhabha Atomic Research Center, Bombay (India). Isotope Div.
K. Krishnamurthy, and S. M. Rao.
J Hydrol, Vol 9, No 3, p 277-293, Nov 1969. 17 p, 6 fig, 2 tab, 14 ref.

Descriptors: *Canal seepage, *Radioactivity techniques, *Tracers, *Tracking techniques, *Reviews, On-site investigations, Seepage, Soil water movement, Groundwater movement, Mathematical studies, Mathematical models.
Identifiers: *India, Ganga Canal.

A brief survey of the many existing computational and experimental methods in estimating seepage losses from unlined canals is given. A new method is suggested in which the filtration velocity of seepage is measured using radioisotopes. The seepage rate is then computed from the knowledge of the phreatic curve and Numerov's theoretical formula for laterally spreading seepages from unlined canals. A practical application of the procedure to estimate seepage losses from Ganga Canal near Roorkee, India is also described. (Knapp-USGS)
W70-01858

SULPHATE DISTRIBUTION IN SOLONETZIC SOIL WITH A WATER TABLE,
Alberta Univ., Edmonton. Dept. of Soil Science.
S. U. Khan, and G. R. Webster.
J Soil Sci, Vol 19, No 1, p 20-24, Mar 1968. 5 p, 1 fig, 1 tab, 9 ref.

Descriptors: *Water chemistry, *Soil chemistry, *Soil water movement, *Sulfates, Ion transport, Aqueous solutions, Adsorption, Mineralogy, Clay minerals.
Identifiers: Solonetz, Sulfate mobility.

Soil columns were used to study sulphate distribution in Thin Duagh Loam soil as influenced by the presence of a water table. The concentration pattern showed that retention was greater in the surface soil than at lower depths. The data suggest that sulphate tends to move more slowly than water in soil. Evaporation would affect the distribution pattern but in this study its influence was negligible because it was maintained at a low level. In the lower horizons the sulphate concentration in the column decreased with decreasing acidity of the soil horizons. In this soil montmorillonite is the major clay mineral and it appears that increase in percentage of clay reduced sulphate retention in the lower horizons. The greater sulphate retention near the surface resulting from high water table in the soil under study might have some effect on the productivity of these soils. (Knapp-USGS)
W70-01866

WATER MOVEMENT IN DRY SOILS: 1. PHYSICAL FACTORS AFFECTING SORPTION OF WATER BY DRY SOIL,
Rothamsted Experimental Station, Harpenden (England).
D. A. Rose.
J Soil Sci, Vol 19, No 1, p 81-93, Mar 1968. 13 p, 9 fig, 4 tab, 9 ref.

Descriptors: *Soil water movement, *Unsaturated flow, Diffusion, Diffusivity, Sorption, Clay minerals, Expansive clays, Expansive soils, Mathematical studies, Model studies, Soil physics, Soil physical properties, Vapor pressure, Evaporation control, Hexadecanol, Temperature.
Identifiers: Atmospheric moisture uptake (Soils).

Semi-infinite columns of dry soil closed at one end had the other exposed to a turbulent atmosphere at constant relative humidity (0.98) and a range of constant temperatures. After varied times the water content of the columns were measured gravimetrically, in 1-cm layers, from which the total quantity taken up and the distribution of water content with time and distance were found. Assuming that the Boltzmann transform can be applied to the standard diffusion equation, two soil parameters are derived. The second parameter--the sorptivity, is not independent of water content or the value maintained at zero distance. Results show that in a clay soil, between pF 5.8 and pF 4.2, water moves predominantly as vapor; in a non-swelling silicate mineral (sepiolite) there is significant liquid movement between pF 5.1 and pF 4.2. Long-continued use of organic manure has little effect on either diffusivity or sorptivity; aggregate size has some effect, in opposite senses for a sand and a clay; a mulch or a still atmosphere affects sorptivity but not diffusivity; evaporation suppressants decrease sorptivity; ignition decreases sorptivity and greatly alters diffusivity; and degradation of structure causes small changes in diffusivity. (Knapp-USGS)
W70-01867

STEADY FLOW OF WATER THROUGH A TWO-LAYER SOIL,
Iowa State Univ., Ames. Dept. of Agronomy.
Sam-Arng Srinilta, D. R. Nielsen, and Don Kirkham.
Pap presented at 50th Annu Meeting of Amer Geophys Union, Wash, DC, Apr 21-25, 1968. 29 p, 17 fig, 1 tab, 12 ref.

Descriptors: *Steady flow, *Soil water movement, *Unsaturated flow, Hydraulic conductivity, Sorption, Bulk density, Soil moisture, Moisture tension, Soil profiles, Soil types, Darcy's law, Anisotropy, Pore pressure.
Identifiers: Two-layer soil, Soil columns.

A laboratory study of water moving steadily through an isothermal, two-layer soil is analyzed using Darcy's equation for unsaturated flow. Factors considered were thicknesses and kinds of topsoil and subsoil, depth of surface water ponding, magnitude of outflow water pressure, and soil-water history of the profile. Soil-water pressure distributions were measured at 5-cm depth intervals along the vertical columns. The unsaturated hydraulic conductivity was measured for sorption and desorption for each of 4 soils used as topsoil and subsoil in the two-layer columns. Values of hydraulic conductivity as a function of soil-water pressure were used to predict the measured soil-water pressure distributions and steady-state fluxes. The agreement between predicted and measured profiles is close. The necessity to distinguish between sorption and desorption, to obtain a uniform soil-bulk density distribution within each soil layer, and to ascertain the hydraulic conductivity as a function of soil-water pressure is discussed in relation to the predicted soil-water pressure distribution and flux values. (Carstea-USGS)
W70-01868

THE INFILTRATION OF ALDRIN THROUGH OTTAWA SAND COLUMNS,
Geological Survey, Idaho Falls, Idaho.
For primary bibliographic entry see Field 05B.
W70-01904

INFLUENCE OF SAMPLE PRETREATMENT ON SOIL MOISTURE RETENTION,
Wisconsin Univ., Madison. Dept. of Soils.
D. E. Elrick, and C. B. Tanner.
Soil Science Society of America, Proceedings, Vol 19, No 3, p 279-282, 1955. 2 fig, 11 ref.

Descriptors: *Soil moisture, *Retention, Soil physics, Tensiometers, Moisture tension, Tension, Moisture content, Moisture availability, Soil texture, Wilting point, Sieve analysis, Puddling, Cores.
Identifiers: *Sample pretreatment.

Moisture retention was compared of 2-millimeter sieved, puddled, and undisturbed soil to determine whether approximate estimates of moisture retention values of undisturbed soil could be estimated by those for sieved soil. Soil samples were saturated with water and their moisture retention values determined at 11 moisture tension points with the range 0.01-15 atmospheres. Results showed that sieved soil can be used to indicate retention values of medium textured, undisturbed soil within the range of 1 to 15 atmospheres with a relative error of 10%. Below 1 atmosphere, retention values of sieved soil differed significantly from undisturbed soil ; thus, for retention values of less than 1.0 atmosphere, estimates should be made directly from undisturbed soil. It was noted that for tensions greater than 5.0 and less than 0.1 atmospheres, puddled soil provided a better estimate of retention values in undisturbed soil than did sieved soil. (Daniel-Wisconsin)
W70-01932

HYDROLOGIC PROPERTIES OF SOILS ON THREE SMALL WATERSHEDS IN THE WESTERN CASCADES OF OREGON,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
C. T. Dyrness.
USDA Forest Serv Res Note PNW-111, Sep 1969. 17 p.

Descriptors: *Soil water, *Soil surveys, *Percolation, *Storage capacity, *Soil stoniness, Soil classification, Soil porosity, Soil water movement, Wilting point, Field capacity, Moisture tension, Soil texture, Capillary water, Gravitational water, Experimental watersheds, Coniferous forests, Watershed management.

All soils mapped on three experimental watersheds were of loamy texture, and most showed minimal amounts of profile development. With one exception, rates of water movement through saturated soil cores were found to be very high. Percolation rates measured for surface horizons were unusually rapid due to the very porous and highly aggregated nature of these layers. Retention (capillary) and detention (gravitational) storage capacity values determined for the surface 4 feet of soil were extremely variable within individual soil series. The single most important factor causing variation was stone content of the soils. Each of the four most widespread soil series was divided into two new soil units on the basis of stone content. The resultant soil units had substantially reduced variation in water storage capacity values. Average retention storage capacity values for the surface 4 feet of soil ranged from approximately 6 to 14 inches, and average detention capacities varied from about 8 to 14 inches. Maximum storage capacity available at the end of the summer dry season is estimated to range from about 30 to 40 percent of the total retention capacity values for these soils.
W70-02040

2H. Lakes

DIVERSION BY LAKE PIERCING, SNETTISHAM PROJECT,
Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 08B.
W70-01661

MICROPARTICULATES: ISOLATION FROM WATER AND IDENTIFICATION OF ASSOCIATED CHLORINATED PESTICIDES,
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
For primary bibliographic entry see Field 05A.
W70-01669

INCREMENTAL STRESS UNDER A TWO-DIMENSIONAL ARTIFICIAL LAKE,
Alberta Univ., Edmonton. Dept. of Physics.
For primary bibliographic entry see Field 08E.
W70-01679

FLOW-THROUGH SAMPLING SYSTEM FOR SMALL BOATS OR ICE SHELTER,
Geological Survey, Washington, D.C.; and Geological Survey, Fort Wayne, Ind.
For primary bibliographic entry see Field 07B.
W70-01900

MAJOR TEMPERATURE CHARACTERISTICS OF WATER IN THE WEST-CENTRAL PART OF THE CASPIAN SEA (IN AZERBAIDZHAN),
For primary bibliographic entry see Field 02B.
W70-01910

AN INVESTIGATION BY RAPID CARBON-14 BIOASSAY OF FACTORS AFFECTING THE CULTURAL EUTROPHICATION OF LAKE TAHOE, CALIFORNIA-NEVADA,
California Univ., Davis. Dept of Zoology; and Engineering-Science Inc., Oakland, Calif.
For primary bibliographic entry see Field 05C.
W70-01933

SEASONAL CHANGES IN THE ATTACHED ALGAE OF FRESHWATER AND SALINE LAKES IN THE LOWER GRAND COULEE, WASHINGTON,
Oregon Univ., Eugene. Dept. of Biology.
Richard W. Castenholz.
Limnology and Oceanography, Vol V, No 1, p 1-28, Jan 1960. 10 fig, 6 tab, 38 ref.

Descriptors: *Algae, *Lakes, *Fresh water, *Saline lakes, *Washington, Alkaline water, Diatoms, Productivity, Conductivity, Hydrogen ion concentration, Dissolved solids, Sampling, Temperature, Ice, Ions, Chlorophyta, Cyanophyta, Primary productivity, Limnology.
Identifiers: *Seasonal effects, *Lower Grand Coulee (Wash), *Epilithic algae, *Epiphytic algae, Cymbella, Diatoma elongatum, Fragilaria vaucheriae, Gomphonema eriense, Nitzchia, Synedra, Epithemia, Rhopalodia gibba, Cladophora, Spirogyra, Oscillatoria, Chlorococcales, Ulothrix, Amphora, Production rate, Species composition, Glass plates, Species diversity, Depth effects, Comparative studies.

Investigations during a two year period of two freshwater alkaline lakes and two saline lakes in Lower Grand Coulee, Washington, have provided quantitative and qualitative records of seasonal changes in non-planktonic algae. Relative dominance was evaluated, based on the mathematical product of the cell count and a calculated volume factor for each species. In freshwater lakes, bimodal production curves, with the peak generally higher in spring than in fall, were evident. Lowest production occurred in late summer. Comparison of two years' results shows differences in total production at comparable times, but seasonal distribution of species was similar. In fresh water, diatom species, dominant in spring, were replaced by others in summer, which was also characterized by an abundance of Cladophora, Spirogyra, Oscillatoria, and members of the Chlorococcales. Dominant summer diatoms usually remained through autumn, and were then joined by several vernal species. In winter, diatom production was low, but Ulothrix clothed rocks in Falls Lake even under ice. Of 275 algal taxa from Lower Grand Coulee, 9% occurred in both fresh water and saline. (Jones-Wisconsin)
W70-01938

USE OF MODIFIED DIURNAL CURVES FOR THE MEASUREMENT OF METABOLISM IN STANDING WATER,
Toronto Univ. (Ontario). Dept. of Zoology.
Harold E. Welch.
Limnology and Oceanography, Vol 13, No 4, p 679-687, 1968. 6 fig, 1 tab, 31 ref.

Descriptors: *Biological communities, *Metabolism, *Methodology, *Photosynthetic oxygen, Oxygen, Photosynthesis, Ponds, Primary production, Georgia, Eutrophication, Carbon dioxide, Hydrogen ion concentration, Sampling.
Identifiers: *Community metabolism, *Diurnal oxygen curves, Winkler technique, Lago Pond (Ga).

A method is described for adapting, to limnetic situations, the estimation of community metabolism from diurnal variations in oxygen concentration of free water. Water samples were taken by vacuum, using polyethylene tubing fitted with baffles to aid in sampling thin layers. Samples, at intervals of 25 centimeters from surface to anaerobic layer (depth, 2.5 meters), were taken each hour to establish diurnal curve of oxygen concentrations, as determined by azide modification of Winkler technique. During course of a year, samples yielded values of corrected gross photosynthesis (in grams oxygen/square meter per day) varying between 2.2 (January) to 10.0 (June-August). This technique avoids disadvantages of bottle methods which are related to sharp chemical stratification of the water column, diurnal migration of algae, and production of gas bubbles. Procedure also minimizes ecosystem disturbance and lessens possible diffusion errors. Chief disadvantage is its dependance on significant volumetric changes in oxygen or carbon dioxide. Figures in the report include a schematic diagram of the sampling system, and representative oxygen and pH profiles of Lago Pond, a small, fertile Georgia farm impoundment. (Voigtlander-Wisconsin)
W70-01941

PROCEEDINGS OF THE CONFERENCE ON CHANGES IN THE BIOTA OF LAKES ERIE AND ONTARIO.
Buffalo Society of Natural Sciences, N.Y.; and State Univ. of New York, Buffalo. Research Foundation.
For primary bibliographic entry see Field 05C.
W70-01942

CHANGES IN THE BIOLOGY OF THE LOWER GREAT LAKES,
Ohio State Univ., Columbus. Natural Resources Inst.
For primary bibliographic entry see Field 05C.
W70-01943

PLANTS IN LAKES ERIE AND ONTARIO, AND CHANGES OF THEIR NUMBERS AND KINDS,
Memorial Univ. of Newfoundland, St. Johns. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W70-01944

CHANGES IN THE BENTHOS OF LAKES ERIE AND ONTARIO,
Toronto Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W70-01945

2I. Water in Plants

ATRIPLEX POLYCARPA: I. GERMINATION AND GROWTH AS AFFECTED BY SODIUM CHLORIDE IN WATER CULTURES,
California Univ., Riverside. Dept. of Agronomy.
N. Jerry Chatterton, and Cyrus M. McKell.
Agronomy Journal, Vol 61, No 3, May-June 1969, p 448-450. 1 tab, 2 fig, 11 ref.

Descriptors: *Salt tolerance, *Plant growth, *Germination, *Desert plants, *Saline soils, Grazing, Soil-water-plant relationships, Halophytes, Seeds, Osmosis, Forages, Sodium chloride, Root development, Growth stages.
Identifiers: *Desert saltbush.

Many of the arid regions of the world have a salinity problem. In this laboratory study the authors report effects of varying levels of sodium chloride on germination and growth of desert saltbush (Atriplex polycarpa)-- an evergreen shrub which offers potential as a forage plant in arid areas. Germination was severely reduced when seedlings were placed in solutions having osmotic potentials of -4.20 atmospheres. At -16.82 atmospheres there was essentially no germination. Growth of established seedlings under greenhouse conditions was reduced but not halted by salt concentrations as great as -24.00 atmospheres osmotic potential (39,000 ppm in solution). Greatest tolerance was shown by plants from a Bishop, California, population. Desert saltbush was found very tolerant to NaCl and was suggested as a good forage plant for supporting grazing in arid areas with high salinity. (Crouse-Arizona)
W70-01800

GRASS SEEDING IN THAL, WEST PAKISTAN,
Norman H. French.
Annals of Arid Zone, Vol 7, No 2, p 221-229, 1968. 2 tab.

Descriptors: *Vegetation regrowth, *Arid lands, *Range management, *Revegetation, *Weed control, *Costs, Range grasses, Economic feasibility, Cost-benefit ratio, Grazing, Forages, Seeds, Livestock, Sands.
Identifiers: *West Pakistan, Reseeding.

Average annual rainfall in the Thal area of West Pakistan ranges between five and eight inches. Such land is too arid to support cultivation, yet investigations showed that it had supported adequate grass for livestock production in the past. Serious overgrazing for possibly a century had changed the ecological complex and all but eliminated desirable species of grass. The problem was to find suitable species that could utilize available soil moisture to support livestock grazing. Research by the Central Arid Zone Research Institute, Jodhpur, India, had indicated certain suitable species. Trials in Thal developed proper methods for seeding and increasing forage from 200 to more than 1500 pounds per acre. Such an increase is apparently possible for millions of acres of similar area. Estimated costs and returns are given together with a guide for proper stocking to maintain forage production. Economic feasibility, however, depends on use of high quality, productive stock. (Crouse-Arizona)
W70-01808

WATER USE AND MANAGEMENT OF PONDEROSA PINE IN NORTHERN ARIZONA,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 03B.
W70-01829

MOISTURE CONDENSATION ON WINTER VEGETATION,
Arizona Univ., Tucson. Dept. of Agricultural Engineering.
K. R. Frost.
Progressive Agriculture in Arizona, Vol 19, No 2, p 20-22, Mar-Apr 1967. 3 p, 5 fig.

Descriptors: *Condensation, *Grasses, *Arizona, *Water yield improvement, *Dewpoint, Dew, Arid lands, Evapotranspiration, Lysimeters, Vegetation effects, Temperature, Moisture availability, Air temperature, Frost.

A study over a period of four winters in arid areas near Tucson, Arizona, showed that nighttime condensation on grasses and grain crops could make a meaningful contribution to the water supply of these crops. Measurements were made with an evapotranspirometer (weighing lysimeter). Part of the condensed moisture entered the soil and was available to the plant roots while part remained on the leaves where it helped reduce evapotranspiration losses during the following day. Analysis of the data showed that nighttime condensation depended on 1.) number of hours the ground level temperature was below dewpoint, (2) ground level air movement, and (3) surface area of the vegetation.

Maximum yield occurred when (1) surface temperature was below dewpoint all night, (2) grass was upright and variable in height, and (3) air movement was relatively low. (Crouse-Arizona)
W70-01835

PLANTS IN LAKES ERIE AND ONTARIO, AND CHANGES OF THEIR NUMBERS AND KINDS,
Memorial Univ. of Newfoundland, St. Johns. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W70-01944

2J. Erosion and Sedimentation

PROPERTIES OF SOME SOILS IN THE CUMBERLAND PLATEAU AS RELATED TO SLOPE ASPECT AND POSITION,
Soil Conservation Service, Beltsville, Md.; Soil Conservation, Knoxville, Tenn.; and Forest Service (USDA), Somerset, Ky.
For primary bibliographic entry see Field 02G.
W70-01649

MAWSON 'TILLITE' IN ANTARCTICA: PRELIMINARY REPORT OF A VOLCANIC DEPOSIT OF JURASSIC AGE,
Maine Univ., Orono. Dept. of Geological Science.
H. W. Borns, Jr., and B. A. Hall.
Science, Vol 166, No 3907, p 870-872, Nov 1969. 3 p, 2 fig, 7 ref. NSF Grant No GA-1148.

Descriptors: *Sedimentary petrology, Glacial drift, *Mudflows, Sedimentary rocks, Antarctic, Sedimentary structures.
Identifiers: Tillite, Volcanic rocks, Pyroclastics.

Reexamination of the Mawson 'Tillite' (Jurassic) of Antarctica indicates that the deposit is of volcanic origin and consists largely of both primary and reworked volcanic materials. No evidence diagnostic of a glacial origin was found. (Knapp-USGS)
W70-01667

GRAYWACKE MATRIX MINERALS: HYDROTHERMAL REACTIONS WITH COLUMBIA RIVER SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, Calif. Geol Res Div, and Washington Univ., Seattle. Dept. of Oceanography.
James W. Hawkins, Jr., and John T. Whetten.
Science, Vol 166, No 3907, p 868-870, Nov 1969. 3 p, 2 tab, 12 ref. NSF Grants GP-3591, GA-15706, and GA-634. AEC contract AT (45-1)-1725.

Descriptors: *Diagenesis, *Water chemistry, *Sediments, Mineralogy, Chemical reactions, Laboratory tests, Geochemistry.
Identifiers: Graywackes, Hydrothermal alteration, Columbia River sediments.

Experiments with sands chemically similar to graywackes produced 'matrix' minerals at 250 deg C and a water pressure of 1 kilobar. Starting materials were moderately well sorted sands containing abundant volcanic rock fragments and no detectable clay minerals. The results support the concept that graywacke matrix may form diagenetically by hydration and recrystallization of unstable clasts. Matrix need not be a recrystallized detrial fine fraction. Texture, therefore, is not a reliable criterion for sandstone classification. For graywackes, chemical composition may be more significant. (Knapp-USGS)
W70-01668

CARBONATE SEDIMENTS: ORIENTED LITHIFIELD SAMPLES FROM THE NORTH ATLANTIC,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.; and Queen's Univ., Kingston (Ontario). Dept. of Geological Sciences.
Grant A. Bartlett, and Robert G. Greggs.
Science, Vol 166, No 3906, p 740-741, Nov 1969. 2 p, 1 fig, 4 ref.

Descriptors: *Carbonate rocks, *Sedimentation, *Lithification, *Atlantic Ocean, Marine geology, Sediment distribution, Stratification, Drill holes, Organic matter, Dating.
Identifiers: *Sediment orientation, *North Atlantic ocean, Nonlithified carbonates, Seamounts.

Differences between oriented indurated carbonate samples, obtained from the North Atlantic sea floor with deep-sea coring apparatus, are described. Two main types of lithology occur in the samples; one is mostly nonlithified layers of corals, gastropods, pelecypods, and foraminifera; the other is a lithified carbonate of hard layers, mostly globigerina-pteropod oozes with a few molluscan fragments, but sometimes lacking in organic constituents. Lithified and nonlithified couplets of sediments can be related in age and orientation as a result of the findings of the described study. Age determinations with carbon-14 show that adjacent layers of lithified and nonlithified carbonate sediments may differ in age by more than 30,000 years. (Lang-USGS)
W70-01678

SEDIMENTS OF THE ANDAMAN BASIN, NORTHEASTERN INDIAN OCEAN,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
Kelvin S. Rodolfo.
Marine Geol, Vol 7, No 5, p 371-402, Oct 1969. 32 p, 15 fig, 1 tab, 43 ref. Grant Nos. GP-2530, GA-730, and GA-1072 NSF.

Descriptors: *Sedimentation, *Sedimentary basins (Geological), *Provenance, *Deposition (Sediments), *Sedimentation rates, Currents (Water), Climates, Sediment distribution, Sediment yield.
Identifiers: Bay of Bengal, Irrawaddy River.

The Andaman Basin is an area of 800,000 sq km separated from the Bay of Bengal by the Andaman-Nicobar Ridge. The basin's principal sediment source is the Irrawaddy River's annual load of about 265 million metric tons of silty clay. Climate and physiography trap most of this sediment in the basin; over 90% of Burmese rainfall, 80% of runoff and 87% of sediment discharge result from the southwest monsoon. Prevailing winds of this season drive westerly currents which displace the turbid Irrawaddy discharge eastward from the river's mouth. The eastern and inner Irrawaddy delta-shelf is accumulating 90% of this sediment at a rate of 200 cm/100 year. Contribution from the Irrawaddy constitutes 86% of the central trough's sediment, the difference being foraminiferal carbonate. Areal patterns of sediment parameters indicate that basinward transport of Irrawaddy sediment is controlled by bottom topography. Depositional rates average 15 cm/1,000 year in the central trough, which has a total fill of about 1.5 km. The beveled Malay continental margin and the absence of any other logical provenance for thick flysch-like Tertiary sediments in the Andaman-Nicobar Ridge suggest that the basin began to form in the Late Miocene as Malaya rifted away from the Andaman-Nicobar Ridge. (Knapp-USGS)
W70-01691

GEOMORPHIC EFFECTS OF THE MAY 1967 FLOOD IN GRABURN WATERSHED, CYPRESS HILLS, ALBERTA, CANADA,
Queen's Univ., Kingston (Ontario); and Bishop's Univ., Lennoxville (Quebec).
J. J. McPherson, and W. F. Rannie.
J Hydrol, Vol 9, No 3, p 307-321, Nov 1969. 15 p, 9 fig, 2 tab, 18 ref.

Descriptors: *Floods, *Erosion, *Sediment yield, Flood plains, Sedimentation, Gravels, Sands, Silts, Clays, Geomorphology, Provenance, Hydrology, Climates, Bed load, Discharge (Water), Stream erosion.
Identifiers: *Canada, Alberta, Graburn watershed.

In May 1967, a flood which was at least a 50 year flood occurred in Graburn watershed in the Alberta Cypress Hills. During the 6 day flood period from May 16th to May 21st, 1,023 tons of sediment were removed in solution, 17,400 tons in suspension and 28,300 tons as bed load. An average thickness of 0.09 feet of fresh overbank material was deposited by the floodwaters. Gravel, as well as the more normal vertical accretion silt and clay material was laid down on the floodplain surface. Comparison of the rate of denudation calculated for the flood (0.0013 feet) with other reported rates, suggest that it is not as high as might be expected for a flood of this magnitude. (Knapp-USGS)
W70-01856

PRELIMINARY EXPERIMENTS ON HYDRODYNAMIC MOVEMENT INDUCED BY EVAPORATION AND THEIR BEARING ON THE DOLOMITE PROBLEM,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
K. Jinghwa Hsu, and Christoph Siegenthaler.
Sedimentology, Vol 12, No 1-2, p 11-25, Apr 1969. 15 p, 2 fig, 1 tab, 29 ref.

Descriptors: *Water chemistry, *Groundwater movement, *Diagenesis, *Dolomite, *Evaporation, Hydraulic gradient, Carbonates, Chemical precipitation, Sands, Silts, Permeability, Porosity, Water levels, Mineralogy, Flow rates, Hydraulic models, Model studies, Hydrodynamics.
Identifiers: *Dolomitization, Evaporative pumping.

Experiments were performed to demonstrate that saline interstitial waters under an arid coastal plain could be set in hydrodynamic movement to replace the evaporative loss near the surface. In contrast to movement in a vadose zone, which is related to capillary forces caused by surface tension, this movement is induced by a vertical hydraulic gradient under the evaporated area. Experiments further verified that flow rate induced by evaporative pumping was directly governed by evaporation alone; linear flow rate through coarse sand and that through very fine silt was approximately the same under the same evaporative condition. Yet the movement apparently obeyed Darcy's law. The gradient was much greater in relative impermeable silt than in permeable sand, as is required if the water to replace evaporative loss is to flow with the same rate through those media. Hydrodynamic movement induced by evaporation could be an effective mechanism to transport magnesium-bearing solutions through relatively impermeable sediments of an arid coastal plain. Dolomitization by evaporative pumping could proceed at a rate to account for the origin of Recent dolomite crusts, and for the great thickness of ancient supratidal dolomites. Dolomitization by seepage reflux or by groundwaters cannot be extensive, because of the inadequate magnesium-supply of such waters. (Knapp-USGS)
W70-01860

EARLY DIAGENETIC CEMENTATION OF RECENT SANDS, FRASER RIVER DELTA, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Geology; and British Columbia Univ., Vancouver. Inst. of Oceanography.
R. E. Garrison, J. L. Luternauer, E. V. Grill, R. D. MacDonald, and J. W. Murray.
Sedimentology, Vol 12, No 1-2, p 27-46, Apr 1969. 20 p, 10 fig, 1 tab, 44 ref.

Descriptors: *Diagenesis, *Sediments, *Calcite, *Sands, *River beds, Groundwater movement, Sedimentation, Water chemistry, Deltas, Saline water intrusion, Sea water, Mineralogy, Calcium carbonate, Chemical precipitation.
Identifiers: British Columbia, Fraser River.

Modern terrigenous sediments cemented by low-magnesian calcite are found in distributary channels and adjacent shallow-water marine localities at the front of the Fraser River delta. These per-

manently submerged areas are usually covered by sea water, including sea water intruded upstream along bottoms of river channels. The cemented sediments occur as irregular to platy nodular masses at or near to sediment-water interface, where they are frequently encountered during dredging. The cement consists of small crystals arranged in fibrous rims and other aggregates around and between sand grains. Processes leading to cementation are not yet known, but may include dissolution of calcareous shells by pore waters in buried sediments, followed by precipitation of calcite at higher levels from these fluids as they are expelled upward during compaction. (Knapp-USGS)
W70-01861

RECENT LITTORAL AND SUBLITTORAL HIGH-Mg CALCITE LITHIFICATION IN THE MEDITERRANEAN,
Uppsala Univ. (Sweden). Dept. of Historical Geology and Paleontology.
Torbjorn Alexandersson.
Sedimentology, Vol 12, No 1-2, p 47-61, Apr 1969. 15 p, 6 fig, 2 plate, 31 ref.

Descriptors: *Diagenesis, *Mineralogy, *Water chemistry, *Lithification, Carbonates, Magnesium, Calcite, Dolomite, Coral, Algae, Reefs, Sediments, Bottom sediments.
Identifiers: Aragonite, Mediterranean.

Lithification caused by inorganic precipitation of high-Mg calcite is reported from several localities in the Mediterranean. A micritic calcite cement with 13-15 mol. % Mg carbonate in solid solution lithifies internal sediments and forms open-space fillings within a sublittoral algal framework in which the biogenic structures are gradually obliterated through the activity of numerous boring organisms and the subsequent precipitation of micrite. The silt-mud fraction of unconsolidated bottom sediments is to a large extent stable low-Mg calcite, and is not the source of the micrite; instead the cementing mineral is assumed to precipitate directly from interstitial sea water aided by organic activity. The same phase of high-Mg calcite also forms the cement in beachrock; the Mg-content is an original property and not the result of diagenetic changes. The cement occurs partly as micrite, identical to the micrite in the lithified algal framework, and partly as radiating microspar fringes. In the present marine environment high-Mg calcite may substitute for aragonite as the mineral form of precipitated calcium carbonate. (Knapp-USGS)
W70-01862

THE CHEMISTRY OF SUBMARINE CEMENT FORMATION AT DOHAT HUSSAIN IN THE PERSIAN GULF,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (The Netherlands).
K. De Groot.
Sedimentology, Vol 12, No 1-2, p 63-68, Apr 1969. 6 p, 1 fig, 2 tab, 9 ref.

Descriptors: *Diagenesis, *Lithification, *Bottom sediments, *Water chemistry, Mud, Carbonates, Calcite, Dolomite, Aqueous solutions, Solubility, Chemical precipitation, Magnesium.
Identifiers: Aragonite, Pore water.

A chemical study made at Dohat Hussain lagoon in Qatar, has supported other field observations that submarine carbonate cementation is probably active today. The source of the cement is the lagoon water, supersaturated with aragonite. In the lagoon the supersaturation is too low to effect spontaneous nucleation and thus precipitation of carbonate, but just below the sediment-water interface both the presence of a stable substrate and supersaturation promote aragonite precipitation. In soft sediment layers in between cemented layers no supersaturation was found. (Knapp-USGS)
W70-01863

OPTIMIZING SEDIMENT SAMPLING PLANS,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 07B.
W70-01870

HOLOCENE INTERTIDAL CALCIUM CARBONATE CEMENTATION, QATAR, PERSIAN GULF,
Illing (V. C.) and Partners, Cheam (England).
For primary bibliographic entry see Field 02L.
W70-01872

SUBMARINE LITHIFICATION OF HOLOCENE CARBONATE SEDIMENTS IN THE PERSIAN GULF,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (The Netherlands).
For primary bibliographic entry see Field 02L.
W70-01873

GRAVELS OF THE SOUTHERN NORTH SEA,
Geological Inst., Groningen (Netherlands).
For primary bibliographic entry see Field 02L.
W70-01874

THE ORIGIN OF HOLOCENE SHELL DEPOSITS IN THE CHENIER PLAIN FACIES OF ESSEX (GREAT BRITAIN),
Queen Mary Coll., London (England).
For primary bibliographic entry see Field 02L.
W70-01875

STRATIGRAPHY AND GEOLOGIC HISTORY OF THE SABKHA, ABU DHABI, PERSIAN GULF,
Imperial Coll. of Science and Technology, London (England). Dept. of Geology; and Mobil Research and Development Corp., Dallas, Tex.
G. Evans, V. Schmidt, P. Bush, and H. Nelson.
Sedimentology, Vol 12, No 1-2, p 145-159, Apr 1969. 15 p, 5 fig, 1 plate, 3 tab, 18 ref.

Descriptors: *Chemical precipitation, *Evaporation, *Arid lands, *Mineralogy, Sediments, Gypsum, Anhydrite, Dolomite, Magnesium, Halides, Salts, Groundwater, Water chemistry, Water temperature, Water levels, Brines, Sea water, Salinity, Sands, Carbonate rocks.
Identifiers: *Persian Gulf, Sabkha, Abu Dhabi, Pore water.

The sabkha, an arid coastal plain of Abu Dhabi on the coast of the Persian Gulf, was formed during the past 7,000 years by wind erosion of pre-existing dunes and progradation of subaqueous, intertidal, and supratidal carbonate sediments. Marine transgression began in this area about 7,000 years ago and reached an apparent high about 1 m above its present level somewhat prior to 4,000 years B. P. Since then progradation of intertidal and supratidal sediments has taken place; this began 3,750 years ago. Arid conditions and evaporation on the sabkha have produced large amounts of gypsum and anhydrite and lesser amounts of dolomite, magnesite, celestite and halite. (Knapp-USGS)
W70-01892

RELATIONS OF JOINTING TO ORIENTATION OF SOLUTION CAVITIES IN LIMESTONES OF CENTRAL PENNSYLVANIA,
Geological Survey, Washington, D.C.
Ruth G. Deike.
Amer J Sci, Vol 267, No 10, p 1230-1248, Dec 1969. 19 p, 10 fig, 2 tab, 9 ref.

Descriptors: *Karst, *Pennsylvania, *Geologic control, Caves, Limestones, Solubility, Joints (Geology), Fractures (Geology), Groundwater movement, Geology, Permeability, Anisotropy, Hydrogeology, Structural geology, Folds (Geology), Geomorphology.
Identifiers: Cave orientation-jointing relations.

Twenty-six caves located in anticlinal, limestone-floored valleys of Central Pennsylvania were studied by division into passage segments inferred to have formed along the strike of fracture planes. Statistically preferred orientations of these segments were calculated. For each cave passage, an average passage orientation was calculated. Fractures measured at outcrops near the caves were classed by their preferred orientations. The average passage orientation compared with the orientation of fracture frequency was significant to the 95% level, and a plot of the relationship proved to be broadly linear. The most abundant fractures are vertical strike joints and steeply dipping bedding planes, and they lie parallel both to the anticlinal axes and down-valley water flow, suggesting increased solution along vertical joints. Individual cave patterns were found to reflect local fracture systems where: (1) linear caves develop along more steeply dipping and probably more closely spaced bedding planes; (2) several caves, particularly along flanks of folds, develop major passages along a set of the same subparallel fractures; (3) as the local structure changes the fracture orientation, the cave passages parallel the local fractures; (4) widely-spaced cave passages develop where intersecting fracture sets are also widely spaced. (Knapp-USGS)
W70-01893

COMPARATIVE RESULTS OF SEDIMENT SAMPLING WITH A SURFACE SAMPLER AND DEPTH-INTEGRATING SAMPLERS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07B.
W70-01897

AN ANALYSIS OF SOME DATA FROM NATURAL ALLUVIAL CHANNELS,
Geological Survey, Tucson, Ariz.
George H. Caddie.
In: Geol Surv Res 1969, Prof Pap 650-C, p C188-C194, 1969. 7 p, 7 fig, 6 ref.

Descriptors: *Sediment transport, *Alluvial channels, *Friction, Sediment discharge, Sediment load, Colorado River, Statistical methods, Data collections, Sampling, Data processing, Discharge (Water).
Identifiers: Glen Canyon Dam.

Recent work on the geometry of stream channels has resulted in a hypothesis that the friction factor of any stream flowing in alluvium is virtually indeterminate because friction is the result of specific constraints placed upon the stream. The relationships between velocity, unit discharge, and slope for several locations on the Colorado River below Glen Canyon Dam are different from those of channels in which depth, velocity, and discharge all vary with changes in load and discharge. Apparently this is so because the stream is degrading its bed at these locations. Some natural streams, unaffected by manmade reservoirs, are shown to have the same characteristics. (Knapp-USGS)
W70-01898

A MUDFLOW IN THE SECOND CREEK DRAINAGE, LAKE TAHOE BASIN, NEVADA, AND ITS RELATION TO SEDIMENTATION AND URBANIZATION,
Geological Survey, Carson City, Nev.
Patrick A. Glancy.
In: Geol Surv Res 1969, Prof Pap 650-C, p C195-C200, 1969. 6 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Mudflows, *Urbanization, *Sedimentation, *Nevada, Erosion, Soil erosion, Mass wasting, Channel morphology, Channel erosion, Floods, Deposition (Sediments).
Identifiers: Lake Tahoe Basin (Nev).

A mudflow of more than 50,000 cubic yards occurred in the 1.5-square-mile Second Creek basin on August 25, 1967, after an intense thundershower. Although the mudflow originated natu-

rally, its path was affected by manmade features. It damaged real estate and roadways in the lower part of the drainage, and also polluted Lake Tahoe. The mudflow probably is typical of one erosional process believed common throughout the area. The sequence includes sheet and rill erosion of non-forested uplands, severe downstream channel erosion that flushes out alluvium previously accumulated as a result of normal runoff and mass wasting, and extensive deposition along the flatter and lower part of the drainage. Estimates suggest that sheet and rill erosion of the upper basin contributed 60 to 80% of the debris, with the rest derived from the main channel. The event caused landscape denudation that averaged about 0.02 ft over the entire basin. Results of this reconnaissance influenced design of drainage structures for a new highway route through the area. (Knapp-USGS)
W70-01899

SIMPLIFIED PUMPING SAMPLER FOR SUSPENDED SEDIMENT,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 07B.
W70-01902

AMINO ACID LEVELS IN THE ARGENTINE BASIN SEDIMENTS: CORRELATION WITH QUATERNARY CLIMATIC CHANGES,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02L.
W70-01934

2K. Chemical Processes

RELATIONSHIPS AMONG ADSORBED PHOSPHATE, SILICA, AND HYDROXYL DURING DRYING AND REWETTING OF KAOLINITE SUSPENSION,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agricultural Research; and Colorado State Univ., Fort Collins.
B. Bar-Yosef, U. Kafkafi, and N. Lahav.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 672-677, Sept-Oct 1969. 6 p, 7 fig, 14 ref. Proj No A-2 (Ford Foundation).

Descriptors: *Adsorption, *Chemical reactions, *Phosphates, *Silica, *Drying, Wetting, Clay minerals, Aqueous solutions, Kaolinite, Acidity, Suspension.
Identifiers: Langmuir equation, Peerless kaolinite.

The effects of drying-wetting cycle of a kaolinite suspension on the relationships between phosphate, silica, and hydroxyl in solution were studied. As predicted by the Langmuir adsorption equation, the concentration of P in the equilibrium solution remained constant during the drying process; in contrast, the concentration of silica increased. A competition between phosphate and silica on adsorption sites was observed between pH 7 and pH 9. The amount of hydroxyls needed to desorb a given amount of phosphate was increased by oven drying the kaolinite in the presence of phosphate. (Carstea-USGS)
W70-01645

REACTIONS OF Ce IN SOLUTION AND SUSPENSIONS OF SOIL HUMIC ACID AND BENTONITE,
Ohio Agricultural Research and Development Center, Wooster; and Ohio State Univ., Columbus.
R. E. Brown, R. E. Franklin, and R. H. Miller.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 677-681, Sept-Oct 1969. 5 p, 6 fig, 1 tab, 13 ref. Grant RH00124 PHS.

Descriptors: *Cesium, *Radioisotopes, *Cation exchange, *Chelation, *Humic acids, Clay minerals, Suspension, Aqueous solutions, Acidity, Bentonite, Hydrogen, Calcium, Potassium, Humic acids, Cation adsorption.
Identifiers: *Ionic strength, *Fission products, Radiocolloids.

The effects of pH, ionic strength of solutions and exchangeable cation on complex formation between Ce and soil colloids were studied in suspensions of humic acid, bentonite clay, and a mixture of these two colloids saturated with Ca or K and H. The equilibrium is shifted towards the radiocolloidal form of Ce as ionic strength and Ce concentration decrease and as pH increases. In the Ca-H saturated system, humic acid adsorbed much greater amounts of Ce than did dentonite. In the K-H saturated systems, similar amounts of Ce were adsorbed by both bentonite and humic acid. A more favorable orientation of the humic acid molecule for chelation of Ce explains the strong bonding of Ce by Ca-humic acid and humic acid-bentonite mixtures. (Carstea-USGS)
W70-01646

ADSORPTION OF NITRATE IN AMORPHOUS AND KAOLINITIC HAWAIIAN SOILS,
Hawaii Univ., Honolulu. Dept. of Soil Science.
B. R. Singh, and Y. Kanehiro.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 681-683, Sept-Oct 1969. 3 p, 1 fig, 2 tab, 16 ref.

Descriptors: *Anion adsorption, *Nitrates, *Anion exchange, *Soil chemistry, Kaolinite, Clay minerals, Soils, Soil types, Sulfates, Chlorides, Water chemistry.
Identifiers: *Hawaiian soils, Akaka silty clay, Wahiawa silty clay, Amorphous soil materials.

The adsorption of nitrate in an amorphous Akaka silty clay and kaolinite Wahiawa silty clay increased consistently with increasing concentration and decreasing pH of the electrolyte solution. The magnitude of adsorption was higher in the Akaka than in the Wahiawa soil. The amount of adsorbed nitrate was notably more when sulfate rather than Cl was used as the replacing anion. It was deduced that while the concentration-dependent nitrate adsorption is due to electrostatic and van der Waal forces, the pH-dependent adsorption is largely due to electrostatic forces. The adsorption of nitrate followed the Freundlich type of isotherm. (Carstea-USGS)
W70-01647

SOLUBILITY OF CALCIUM CARBONATE PRECIPITATED IN AQUEOUS SOLUTIONS OF MAGNESIUM AND SULFATE SALTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
H. E. Doner, and P. F. Pratt.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 690-693, Sept-Oct 1969. 4 p, 4 tab, 17 ref.

Descriptors: *Solubility, *Calcium carbonate, *Aqueous solutions, Water chemistry, Magnesium, Sulfates, Salts, Carbon dioxide, Sodium chloride, Magnesium compounds, Calcite, Analytical techniques, X-ray diffraction, Soils, Soil water.
Identifiers: Soil water chemistry.

Calcium carbonates were precipitated in the presence of various salts at controlled carbon dioxide partial pressures. Solubilities of the precipitates were compared with that of calcite and the precipitates were compared with that of calcite and the precipitates were subjected to X-ray diffraction for the detection of crystalline products and in some cases analyzed for coprecipitated Mg. In NaCl solutions, the solubility of the carbonate was that of calcite. In magnesium chloride solutions, the solubility of the precipitate was higher than that of calcite, both calcite and aragonite were detected and Mg was coprecipitated in the solid phase. In solutions of sodium sulfate, the solubility of the precipitate was higher than in the case of the magnesium chloride solutions and both calcite and vaterite were detected. In solutions of magnesium sulfate, the solubility of the precipitate was intermediate between that of the magnesium chloride solutions and the sodium sulfate solutions. The solubility product of calcium carbonate seemed to be related mainly to the nature of the solid phase. (Carstea-USGS)
W70-01648

EVALUATING THE USE OF Na, Ca, AND DIVALENT CATION ELECTRODES IN SOME SOIL EXTRACTING SOLUTIONS,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 02G.
W70-01653

STANDARD HEATS AND ENTROPIES OF EXCHANGE FOR ALKALI METAL CATIONS ON WYOMING BENTONITE,
UT-AEC Agricultural Research Lab., Oak Ridge, Tenn.; Louvain Univ. (Belgium). Inst. of Agronomy; and Fisk Univ., Nashville, Tenn.
R. G. Gast, Robert Van Bladel, and K. B. Deshpande.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 661-664, Sept-Oct 1969. 4 p, 3 fig, 2 tab, 12 ref.

Descriptors: *Thermodynamics, *Heat, *Cation exchange, *Entropy, *Clay minerals, Bentonite, Sodium, Potassium, Selectivity, Enthalpy, Hydration.
Identifiers: *Ion hydration, *Clay-water systems, Standard heats, Standard entropy, Standard enthalpy.

Standard heats of exchange for alkali metal cation exchange on Wyoming bentonite were determined directly using a Calvet microcalorimeter and indirectly from the temperature dependence of equilibrium selectivity coefficients. Standard entropies of exchange were calculated by combining the standard heats with free energy values estimated from equilibrium selectivity coefficient determinations. While the entropy changes did contribute significantly to the standard free energies of exchange, they were only about 10% of the hydration entropy differences for Na-Li and Na-K exchange and 26 and 41% for Na-Rb and Na-Cs exchange, respectively. Both standard heat and standard free energy were always negative for uptake of the preferred cation, and absolute values increased with the degree of selectivity. (Carstea-USGS)
W70-01665

THEORETICAL CONSIDERATION OF THE CALCIUM SULFATE-BICARBONATE-CARBONATE INTERRELATION IN SOIL SOLUTION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
F. S. Nakayama.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 668-672, Sept-Oct 1969. 5 p, 5 fig, 2 tab, 13 ref.

Descriptors: *Thermodynamics, *Water chemistry, *Bicarbonates, *Carbonates, *Sulfates, Water quality, Aqueous solutions, Soil physical properties, Soil chemical properties, Gypsum, Reclamation, Soil water, Ions, Soil moisture, Acidity, Chemical potential.
Identifiers: *Ion-pairs distributions, Activity, Activity coefficients.

The probable distributions of the ion-pairs calcium-sulfate and calcium-carbonate and complex calcium bicarbonate ion in solution are discussed thermodynamically and graphically in terms of sulfate, carbonate, bicarbonate, and hydrogen ion activities. In alkali media where the carbonate form predominates, the calcium carbonate species will dominate the calcium sulfate and calcium bicarbonate forms, and is a significant part of the total calcium in solution. The complexed and undissociated forms of Ca represent a significant portion of the total Ca in solution at equilibrium. Reclamation projects involving the improvement of soil physical and chemical properties using gypsum and other Ca sources require an understanding of these relationships. (Carstea-USGS)
W70-01666

GRAYWACKE MATRIX MINERALS: HYDROTHERMAL REACTIONS WITH COLUMBIA RIVER SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, Calif. Geol Res Div, and Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 02J.
W70-01668

CHEMICALS FROM SEA WATER BRINES,
Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 03A.
W70-01674

THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS OF METAL SALTS IN MULTICOMPONENT SALT SOLUTIONS,
Tyco Labs., Inc., Waltham, Mass.
For primary bibliographic entry see Field 03A.
W70-01676

GEOCHEMISTRY OF DEEP WATERS AND OF THE ORGANIC MATTER IN THE NORTHERN PART OF THE G. D. R. (GERMAN),
Research Inst. for the Reconnaissance and Requirements of Petroleum and Natural Gas, Gommern (East Germany).
For primary bibliographic entry see Field 02L.
W70-01680

CARBON DIOXIDE PARTIAL PRESSURE IN THE COLUMBIA RIVER,
Oregon State Univ., Corvallis. Dept. of Oceanography.
P. K. Park, L. I. Gordon, S. W. Hager, and Milton C. Cissell.
Science, Vol 166, No 3907, p 867-868, Nov 1969. 2 p, 2 fig, 7 ref. NSF Grants GP-5317, GA-1281, and GA-12113, and ONR Contract Nonr 1286-(10).

Descriptors: *Carbon dioxide, *Water chemistry, *Columbia River, Hydrogen ion concentration, Water temperature, Solutes, Aqueous solutions, Analytical techniques.
Identifiers: Dissolved carbon dioxide.

Columbia River water is supersaturated with respect to atmospheric carbon dioxide by 200 to 870 parts per million. An equilibrium exists between the carbon dioxide partial pressure and pH, and Henry's law is obeyed in this natural water. The carbon dioxide pressure can be calculated by a determination of the pH, total carbon dioxide, and temperature. (Knapp-USGS)
W70-01699

PRELIMINARY EXPERIMENTS ON HYDRODYNAMIC MOVEMENT INDUCED BY EVAPORATION AND THEIR BEARING ON THE DOLOMITE PROBLEM,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 02J.
W70-01860

THE CHEMISTRY OF SUBMARINE CEMENT FORMATION AT DOHAT HUSSAIN IN THE PERSIAN GULF,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (The Netherlands).
For primary bibliographic entry see Field 02J.
W70-01863

SULPHATE DISTRIBUTION IN SOLONETZIC SOIL WITH A WATER TABLE,
Alberta Univ., Edmonton. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W70-01866

MAN-MADE CARBON-14 IN DEEP PACIFIC WATERS: TRANSPORT BY BIOLOGICAL SKELETAL MATERIAL,
Scripps Institution of Oceanography, La Jolla, Calif.; and Tata Inst. of Fundamental Research, Bombay (India).
For primary bibliographic entry see Field 05A.
W70-01871

STRATIGRAPHY AND GEOLOGIC HISTORY OF THE SABKHA, ABU DHABI, PERSIAN GULF,
Imperial Coll. of Science and Technology, London (England). Dept. of Geology; and Mobil Research and Development Corp., Dallas, Tex.
For primary bibliographic entry see Field 02J.
W70-01892

GEOCHEMISTRY OF IRON IN A COASTAL-PLAIN GROUND WATER OF THE CAMDEN, NEW JERSEY, AREA,
Geological Survey, Trenton, N.J.
Donald Langmuir.
In: Geol Surv Res 1969, Prof Pap 650-C, p C224-C235, 1969. 12 p, 6 fig, 4 tab, 34 ref.

Descriptors: *Geochemistry, *Iron, *Groundwater, *Coastal plains, *New Jersey, Aquifers, Groundwater movement, Water chemistry, Water quality, Ions, Thermodynamics, Mineralogy, Oxidation-reduction potential, Hydrogen ion concentration.
Identifiers: Camden (NJ), Groundwater chemistry.

In northern Camden and northwestern Burlington Counties, N.J., the pH of groundwater in the Potomac Group and the Raritan and Magothy Formations of Cretaceous age ranges from 5-6 in the outcrop area to 8 several miles downdip to the southeast. Iron is present in the groundwater as dissolved Fe (2) ion and FeOH ion, and as suspended ferric oxyhydroxides, presumably formed by oxidation of ferrous species already in solution. The oxyhydroxides are probably a mixture of amorphous material and goethite with small amounts of hematite. In the outcrop area the concentration of dissolved ferrous or suspended ferric species is less than 0.5 milligrams per liter in unpolluted waters. Just downdip from the outcrop area, ferrous and ferric iron species increase abruptly to about 6-7 mg/l and 6-11 mg/l, respectively. Farther downdip at pH above 6.5, both forms of iron decrease gradually to less than 0.5 mg/l. The decrease in ferrous species is not due to siderite precipitation, but may reflect an increase in the stability of suspended amorphous material owing to aging, coupled with adsorption of ferrous iron by the oxyhydroxides and partial conversion of the amorphous phase to goethite. The decrease in suspended ferric species is probably caused by cation absorption, aging, coagulation, and settling. (Knapp-USGS)
W70-01905

ORIGIN OF THE MINERALIZATION OF THE PHREATIC WATERS IN THE BUZAU-RIMNICUL SARAT INTERFLUVIAL PLAIN (ROMANIAN),
Babes-Bolyai Univ., Cluj (Rumania).
For primary bibliographic entry see Field 02F.
W70-01908

2L. Estuaries

CARBONATE SEDIMENTS: ORIENTED LITHIFIELD SAMPLES FROM THE NORTH ATLANTIC,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.; and Queen's Univ., Kingston (Ontario). Dept. of Geological Sciences.
For primary bibliographic entry see Field 02J.
W70-01678

GEOCHEMISTRY OF DEEP WATERS AND OF THE ORGANIC MATTER IN THE NORTHERN PART OF THE G. D. R. (GERMAN),
Research Inst. for the Reconnaissance and Requirements of Petroleum and Natural Gas, Gommern (East Germany).
E. Peter Muller.
Russian and English summaries. Zeitschrift fur Angewandte Geol, Band 15, Heft 3, p 113-124, Mar 1969. 12 p, 13 fig, 5 tab, 31 ref.

Descriptors: *Geochemistry, *Deep water, Water chemistry, Organic matter, Sedimentary rocks, Groundwater, Saline water, Porosity, Geology, Stratigraphy, Carbonates, Brines, Chlorine, Potassium, Sodium, Calcium, Magnesium.
Identifiers: German Democratic Republic.

Saline waters of the German Democratic Republic were investigated for their salinity and organic matter contents to provide data for geochemical oil prospecting. The distribution and concentration of organic matter in the deep waters depends on the stratigraphy and lithological parameters of the formations. Analysis of deep waters found in the Strassfurt carbonate formation of Permian age is used to illustrate the influence on deep waters of the formation and diagenesis of the aquifer. (Gabriel-USGS)
W70-01680

SEDIMENTS OF THE ANDAMAN BASIN, NORTHEASTERN INDIAN OCEAN,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02J.
W70-01691

OPTIMIZING SEDIMENT SAMPLING PLANS,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 07B.
W70-01870

MAN-MADE CARBON-14 IN DEEP PACIFIC WATERS: TRANSPORT BY BIOLOGICAL SKELETAL MATERIAL,
Scripps Institution of Oceanography, La Jolla, Calif.; and Tata Inst. of Fundamental Research, Bombay (India).
For primary bibliographic entry see Field 05A.
W70-01871

HOLOCENE INTERTIDAL CALCIUM CARBONATE CEMENTATION, QATAR, PERSIAN GULF,
Illing (V. C.) and Partners, Cheam (England).
J. C. M. Taylor, and L. V. Illing.
Sedimentology, Vol 12, No 1-2, p 69-107, Apr 1969. 39 p, 2 fig, 6 plate, 2 tab, 42 ref.

Descriptors: *Lithification, *Diagenesis, *Carbonate rocks, *Bottom sediments, Chemical precipitation, Water chemistry, Sea water, Carbonates, Calcite, Dolomite, Magnesium, Mineralogy, Petrology.
Identifiers: *Persian Gulf, Qatar, Aragonite.

Cemented layers in the shallow lagoonal, intertidal, and supratidal sediments surrounding the Qatar Peninsula, Persian Gulf, contain high-magnesian calcite and aragonite cements. The magnesian calcite appears to occur both as a primary precipitate and as a replacement of aragonite. These cements are believed to be forming today from sea-derived waters. Radiocarbon dating sets an upper age limit of about 4,500 years. Two major types of cemented layer can be distinguished: beachrocks form variably cemented units about 1 m thick at the surface of freely draining exposed beaches; cemented sheets a few cm thick form beneath the surface of broad intertidal sand flats by the growth, hardening, and coalescence of small friable lumps near low-tide level. Replacement of aragonite matrix, druse, and pellets by microcrystalline magnesian calcite is accomplished

by dissolution and reprecipitation; detail is obliterated but the gross features of the original fabric are preserved. The process helps to explain the crystal fabrics of many older limestones. (Knapp-USGS)
W70-01872

SUBMARINE LITHIFICATION OF HOLOCENE CARBONATE SEDIMENTS IN THE PERSIAN GULF,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (The Netherlands).
Eugene A. Shinn.
Sedimentology, Vol 12, No 1-2, p 109-144, Apr 1969. 36 p, 36 fig, 2 tab, 16 ref.

Descriptors: *Lithification, *Diagenesis, *Carbonate rocks, *Bottom sediments, Chemical precipitation, Water chemistry, Sea water, Sands, Carbonates, Calcite, Dolomite, Magnesium, Mineralogy, Petrology.
Identifiers: *Persian Gulf, Aragonite, Pore water.

Large areas of the sea floor in the Persian Gulf are composed of lithified carbonate sediment. That this cementation is contemporaneous and occurs within the present submarine environment has been proven by carbon dating, the presence of pottery and other artifacts within the lithified sediments, and other methods. Although the chemistry of the processes resulting in lithification is unknown it would seem not to require any special conditions other than carbonate-saturated sea water. The process seems to be operating in areas of relatively normal salinity and temperatures in depths ranging down to 30 m. It is deduced that the principal physical factors involved are relatively low rates of sedimentation, sediment stability, and high initial permeability of the sediments. The principal types of cement filling the intergranular spaces and locally replacing grains are aragonite (in several growth forms) and microcrystalline magnesium calcite. The aragonite cement seems to be unstable and has inverted locally to more stable calcite within the marine environment. Lithification results indirectly in the production of several other features all of which in the past have been regarded as criteria for unconformity. (Knapp-USGS)
W70-01873

GRAVELS OF THE SOUTHERN NORTH SEA,
Geological Inst., Groningen (Netherlands).
H. J. Veenstra.
Marine Geol, Vol 7, No. 5, p 449-464, Oct 1969. 16 p, 10 fig, 16 ref.

Descriptors: *Gravels, *Glacial drift, *Provenance, Sedimentation, Sampling, Mineralogy, Sediment transport, Pleistocene epoch.
Identifiers: *North Sea.

Gravels of six regions in the North Sea show differences in composition, grain size and roundness. The gravels in the Hinder Bank and Thames estuary regions represent reworked river deposits. The material near the Suffolk coast is better rounded and is a fossil beach gravel. These deposits were formed between Lower Tertiary and Lower Holocene. The gravel belt off the British coast contains many components that are not derived from rocks in the immediate surroundings. The gravels in the region of the Dogger Bank and Inner Well Bank Rough show analogous compositions pointing to a glacial origin. The gravel of the Dogger Bank was brought from the west by the land-ice of the Last Glacial. The gravel of the Cleaver Bank, east of the Dogger Bank, shows much flint of Scandinavian origin. The gravel of the Texel Rough is of Scandinavian origin, but here the moraines belong to the Saale (Penultimate) Glacial. Generally, the coarsest material is found on top of the elevations in the central North Sea, whereas more and finer gravel occurs in the deeper surroundings, thus indicating selection by waves during the low sea levels of the Lower Holocene. (Knapp-USGS)
W70-01874

THE ORIGIN OF HOLOCENE SHELL DEPOSITS IN THE CHENIER PLAIN FACIES OF ESSEX (GREAT BRITAIN),
Queen Mary Coll., London (England).
J. T. Greensmith, and E. V. Tucker.
Marine Geol, Vol 7, No 5, p 403-425, Oct 1969. 23 p, 11 fig, 38 ref.

Descriptors: *Sedimentation, *Shellfish, Sands, Currents (Water), Waves (Water), Sediment transport, Provenance, Aggradation, Erosion, Marine geology, Movement, Reefs, Sediment distribution.
Identifiers: *Cheniers, *Great Britain, Essex.

The chenier plain facies, extending 20 km northwards from the mouth of the Thames estuary, includes shell concentrations in the form of offshore banks and sheets with a maximum relief of 4 m, marsh edge sheets and ridges (cheniers) of lower relief, and shallow channel and pocket fills. Older inland shell deposits occupying the top 4m of a narrow 0.1-1 km wide zone running slightly oblique to the present coastline are predominantly degraded cheniers. They do not exhibit marked topographic relief. The modern cheniers are asymmetric bodies, crudely layered and crossbedded but devoid of imbricate structure. They are very mobile and migrate during storm periods across the salt marshes. The bulk of the shells are derived from living communities near low water mark and from sub-littoral communities, particularly those living in adjacent estuary channels. The history of the modern shell deposits since 1946 shows that their growth is largely dependent on two factors, mass mortality in the channel communities and the reworking of pre-existing shell sheets interbedded with mud-silt and fine sand of the intertidal zone. Sheets exposed at the salt marsh edge are important contributors at the present time. Growth is more pronounced during regional phases of tidal flat erosion. (Knapp-USGS)
W70-01875

A STUDY OF THE PHYSICAL HYDROGRAPHY OF THE PATUXENT RIVER AND ITS ESTUARY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Wadsworth Owen.
Res partly sponsored by Univ of Maryland, Natur Resources Inst. Chesapeake Bay Inst Tech Rep No 53, Johns Hopkins Univ, Apr 1969. 78 p, 26 fig, 2 tab, 20 ref, 2 append. Proj No NR 083-016, Contract Nos Nonr 248 (20) and Nonr 4010 (11), (Office of Naval Research).

Descriptors: *Hydrography, *Estuaries, *Rivers, *Maryland, *Stratified flow, Stratification, Salinity, Saline water intrusion, Water quality, Tidal effects, Water circulation, Streamflow, Dissolved oxygen, Hydrogen ion concentration.
Identifiers: Patuxent Estuary.

The Patuxent River, which has the largest drainage basin in the State of Maryland, is an estuary tributary to the Chesapeake Bay which itself is an estuary. A distinguishing feature of the Patuxent Estuary is its intermittent transition from a two-layer flow system to a three-layer flow system, a transition which occurs most often in the month of April. The data, for the most part, reveal the seasonal trends common to the other estuaries tributary to the Chesapeake Bay. The salinity is highest in the autumn months and lowest in the spring during the month of April. The water temperature follows the seasonal trends in the air temperature as might be expected for an estuary in a temperature climate. It seems reasonably certain that the three-layered flow which exists intermittently in the Patuxent is caused by a phase difference in fresh water inputs from the Susquehanna and from the Patuxent. (Knapp-USGS)
W70-01890

HYDROGEOLOGICAL RESEARCH IN THE DANUBE DELTA (ROMANIAN),
State Geological Committee, Bucharest (Rumania).
For primary bibliographic entry see Field 02F.
W70-01907

MODEL SIMULATION OF SALINITY INTRUSION IN TIDAL ESTUARIES,
University of Strathclyde, Glasgow (Scotland).
D. I. H. Barr.
The Engineer, Vol 216, p 885-893, Nov 29, 1963. 6 fig, 1 tab, 31 ref.

Descriptors: *Model studies, *Estuaries, *Tides, *Saline water intrusion, Froude number, Reynolds number, Thermal pollution.

The purpose of this study is to explain certain aspects of model simulation of natural phenomena. One of the aspects studied was the exaggeration of the vertical scale and why it is a theoretical as well as a practical necessity. Then, consideration was given the further complication involved when simulation of salinity intrusion is required in tidal models. Because there is a link between all model experiments involving extended gravitational flow - free surface or internal and steady state or non-steady state - and it is proposed that the most appropriate parameters for the correlation and comparison of results from differing examples of such studies are the Froude-Reynolds number and the densimetric Froude-Reynolds number. Some conclusions were: (a) The congruency diagram method of scaling for heat dissipation models is essentially a facet of the whole problem of the scaling of free surface models where head loss is important. (b) Need of the exaggeration of the vertical scale in extension models is fundamental. Exaggeration will always cause some distortion; the well-mixed type of intrusion is in many ways more amenable to the model study approach than the power-station heat dissipation problem. (Guerrero-Vanderbilt)
W70-01918

AMINO ACID LEVELS IN THE ARGENTINE BASIN SEDIMENTS: CORRELATION WITH QUATERNARY CLIMATIC CHANGES,
Illinois Univ., Urbana.
F. J. Stevenson, and C-N Cheng.
Journal of Sedimentary Petrology, Vol 39, No 1, p 345-349, 1969. 3 fig, 1 tab, 17 ref.

Descriptors: *Amino acids, *Sediments, *Quaternary period, Pleistocene epoch, Marine geology, Distribution patterns, Nitrogen compounds, Nitrogen cycle, Geochemistry, Cores, Soil chemistry.
Identifiers: *Argentine Basin, *Climatic changes, Pleistocene glaciation, Marine sediments, Chemical processes.

Studies of three cores of Argentine Basin sediments, approximately 850 to 1200 centimers in length, taken from 640 to 920 nautical miles offshore, showed a close correlation between variations in the depth distribution of amino acids (100-400 micrograms amino acid nitrogen/gram sediment) and climatic fluctuations resulting from Pleistocene glaciation. Except for the top layers, which are presumed not to have attained equilibrium levels, zones of highest amino acid accumulation corresponded to sedimentary material deposited during periods of maximum ice accumulation on the continents. The appearance of corresponding amino acid layers at shallower depths in sediments further away from the mainland is said to be due to slower sedimentation rates with increasing distance from the shore. Further explanations of the observed patterns are offered. (Browman-Wisconsin)
W70-01934

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

EFFECT OF SOIL MOISTURE REGIME AND ROW SPACING ON GRAIN SORGHUM PRODUCTION,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
Z. Plaut, A. Blum, and I. Arnon.
Agronomy Journal, Vol 61, No 3, p 344-347, May-June 1969. 2 tab, 3 fig.

Descriptors: *Irrigation practices, *Semiarid climates, *Water conservation, *Sorghum, *Evapotranspiration, Crop production, Soil-water-plant relationships, Soil moisture, Crop response, Grains (Crops), Irrigation efficiency, Leaves, Moisture availability, Rates of application, Timing.
Identifiers: *Israel, Leaf area duration, Row spacing.

Grain sorghum is widely grown in arid and semiarid climates using irrigation agriculture. The authors of this article conducted an experiment using different irrigation regimes on grain sorghum production in semiarid central Israel. With heavier irrigation rates total evapotranspiration almost doubled, from 270 mm. to 530 mm. Total dry matter increased linearly with increased water use. However, a sigmoid relationship was found between grain yield and total evapotranspiration, indicating a decreasing rate if productivity when water was applied beyond a certain rate. The greatest water efficiency was with two irrigations to field capacity when the second was delayed until the milk stage of the crop. Changes in row spacing had little effect on yield. (Crouse-Arizona)
W70-01803

3A. Saline Water Conversion

PERFORMANCE OF POROUS CELLULOSE ACETATE MEMBRANES FOR THE REVERSE OSMOSIS TREATMENT OF HARD AND WASTE WATERS,
Ottawa Pollution Control Center (Ontario); and National Research Council of Canada, Ottawa (Ontario). Div. of Applied Chemistry.
For primary bibliographic entry see Field 05D.
W70-01644

ELECTROSORPTION AND DESORPTION PROCESS FOR DEMINERALIZATION,
Southern Research Inst., Birmingham, Ala.
Robert E. Lacey.
Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402 - Price $1.25 per copy. Office of Saline Water Res and Develop Progr Rep No 398, 1969. 117 p, 29 fig, 14 tab, 2 append. Contract No 14-01-0001-975 OSW.

Descriptors: *Desalination, *Desalination processes, *Adsorption, *Demineralization, *Membrane processes, Electrodialysis, Membranes, Brackish water, Water quality, Analytical techniques, Cost analysis, Cost comparisons.
Identifiers: *Electrosorption, *Desorption, Electrosorption membranes.

An improved design for electrosorption stacks, and methods of making acceptable electrosorption membranes have been developed. Operating characteristics of the improved electrosorption stack were determined in laboratory experiments and then the stack was used in the field to demineralize two types of natural brackish waters. The field evaluation unit was operated 24 hours a day for periods up to 54 days to determine the best operating conditions to be used with these natural waters. Electrodialysis experiments were conducted with the same waters. The data from the long-term evaluations of demineralization performance were used for estimating the cost of demineralizing these two waters by electrosorption and by electrodialysis. The cost estimates indicated the cost of demineralization by electrosorption would be lower than that for demineralization by electrodialysis by about 17% for one of the waters and about 6% for the other. (Carstea-USGS)
W70-01671

HYDRODYNAMIC STUDIES FOR ELECTRODIALYSIS,
McDonnell Douglas Astronautics Co., Newport Beach, Calif.
G. Belfort, and G. A. Guter.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $1.25 per copy. Office of Saline Water Res and Develop Progr Rep No 459, July 1969. 144 p, 87 fig, 15 tab, 14 ref. Contract No 14-01-0001-1313 OSW.

Descriptors: *Hydrodynamics, *Electrodialysis, *Desalination processes, Photography, Membranes, Brines, Ion exchange, Porosity, Flow, Electrical resistance, Screens, Head loss.
Identifiers: *Spacer screens, Drag coefficient.

The hydrodynamic effectiveness of various spacer screens for electrodialysis was studied with the aid of a novel photographic technique in which exposed photographic paper was used in the place of ion-selective membranes, and photographic developer was used in the place of brine. This technique produced a visual record of the membrane-solution interfacial flow patterns in electrodialysis cells. Additional tests were conducted on each screen with respect to porosity, dead flow area, drag coefficient, and influence on electrial resistance. Some screens are considerably more effective than others in improving electrodialysis performance, especially at flow rates that give Reynolds numbers greater than 180. Seven (out of 21) of the more promising screens were further evaluated in electrodialysis batch tests to determine how current efficiency, membrane stack pressure drop, and total power requirements vary with flow rate. Two new materials, not previously used in commercial electrodialysis equipment are recommended for further study. (Carstea-USGS)
W70-01672

CHEMICALS FROM SEA WATER BRINES,
Office of Saline Water, Washington, D.C.
Lee Leiserson, and Paul C. Scott.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $0.35 per copy. Office of Saline Water Res and Develop Progr Rep No 445, Aug 1969. 25 p, 5 tab, 29 ref.

Descriptors: *Sea water, *Desalination, Sodium chloride, Economics, Research and development, Saline water, Disposal, Elements (Chemical), Brackish water, Brine disposal.
Identifiers: *Mineral recovery.

The methods of recovery of chemicals from desalting plant effluents are reviewed. The production of saturated brine, sodium chloride, and other minerals from brine effluents can be of economical importance under appropriate conditions. The production requires relatively simple technology. Areas needing more research in economical recovery are outlined. (Carstea-USGS)
W70-01674

AN ECONOMIC AND ENGINEERING ANALYSIS OF THE ELECTRODIALYSIS PROCESS,
Bechtel Corp., San Francisco, Calif.
J. Winston Porter, and S. Clerney.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 - Price $2.50 per copy. Office of Saline Water Res and Develop Rep No 470, Aug 1969. 155 p, 22 fig, 25 tab, 9 ref, 4 append. Contract No 14-01-0001-1704 OSW.

Descriptors: *Electrodialysis, *Desalination, *Cost analysis, Pilot plants, Membranes, Computer programs, Economic efficiency, Membrane process, Water costs.
Identifiers: *Economic analysis, *Engineering analysis, Reinforced membrane.

The electrodialysis process was studied in plants of 1, 10, and 50 million gallons per day capacity, treating each of 3 reference brackish waters. The plants used both reinforced and unreinforced membranes. A computer algorithm was developed to perform necessary process and plant design calculations in order to provide capital and water costs for each plant. The calculated information includes: (1) the effect of power cost and feedwater temperature on desalted water costs; (2) an analysis of critical components and their effect on desalted water costs; and (3) the effect on desalted water costs of certain projected technology items. (Carstea-USGS)
W70-01675

THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS OF METAL SALTS IN MULTICOMPONENT SALT SOLUTIONS,
Tyco Labs., Inc., Waltham, Mass.
James N. Butler.
Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402 - Price $1.50 per copy. Office of Saline Water Res and Develop Progr Rep No 388, Oct 1968. 175 p, 40 fig, 18 tab, 133 ref. Contract No 14-01-0001-607 OSW.

Descriptors: *Electrodes, *Thermodynamics, *Reverse osmosis, *Desalination processes, Electrodialysis, Potassium, Calcium, Adsorption, Solvent extractions, Ion exchange.
Identifiers: *Amalgam electrodes, *Activity, Activity coefficients, Alkali metal electrode, Glass electrode, Electrosorption, Irreversible thermodynamics, Lithium.

The theory of irreversible thermodynamics is used to show the importance of activity as opposed to concentration in the electrodialysis and reverse osmosis processes in desalination. The discussion includes: (1) activity coefficient measurements in the aqueous multicomponent systems NaCl-Na sulfate, NaCl-LiCl; (2) thermodynamics and kinetics of the alkali metal amalgam electrode; (3) interference by a second cation such as potassium or lithium; (4) measurements of the standard potential of the lithium amalgam electrode; (5) the alkaline earth amalgam electrodes, particularly calcium and barium; and (6) techniques for handling amalgam electrodes, chloride and sulfate-reversible reference electrodes, glass electrodes and liquid ion exchange electrodes. The activity of individual components is important in solvent extraction, adsorption, electrosorption and scale formation. Activity measurements using a calcium-sensitive specific ion electrode are reported, and the theory of the activity of calcium ion in multicomponent solutions is discussed. A possible method based on the Bronsted theory for prediction of activity coefficients in multicomponent mixtures is presented. Experimental studies of the calcium amalgam and barium amalgam electrodes are summarized. (Carstea-USGS)
W70-01676

FREON-12 HYDRATE DESALTING PROCESS,
Mason-Rust, Lexington, Ky.
Kenneth Garrison, R. J. Slape, and L. L. Snedden.
Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402 - Price $3.75 per copy. Office of Saline Water Res and Develop Progr Rep No 368, Aug 1968. 181 p, 17 fig, 6 chart, 21 photo, 2 tab, 61 ref. Contract No 14-01-0001-1179 OSW.

Descriptors: *Desalination processes, *Pilot plants, *Hydrates, *Sea water, *North Carolina, Desalination, Hydration, Brines, Filtration, Heat exchan-

gers, Instrumentation, Condensation, Research and development.
Identifiers: *Koppers hydrate process, Research and Development Test Station, Wrightsville Beach (NC).

This report summarizes the operational program conducted on the Koppers hydrate process at the Research and Development Test Station at Wrightsville Beach, North Carolina. The process studied consists of: (1) formation of gaseous hydrate in sea water; (2) brine removal from hydrate by filtration and washing; (3) decomposition by direct contact with condensing hydrating agent vapor, and (4) heat exchange with sea water. The hydrate process is technically feasible as shown by the fact that the 10,000 gpd plant operated without shutdown for 28 consecutive days. Production was approximately 300 gpd resulting in a product water of 101 ppm minimum salinity. Downtime was caused mainly by mechanical failures, lack of instrumentation, lack of control, and inadequate processing equipment. The hydrate pilot plant can be improved, and means of improvement are discussed. (Carstea-USGS)
W70-01677

CONCEPTUAL DESIGN STUDY OF A 50 MILLION GALLON PER DAY MSF DESALINATION PLANT AND TEST MODULE.
Fluor Cor., Ltd. Los Angeles, Calif.

OSW R and D Progr Rept No 233, Nov 1966. 97 p, 24 fig, 24 ref.
Identifiers: *Conceptual designs, *Flowsheets, *Multistage flash distillation, Capitalized costs, Construction costs, Cost breakdowns, Design, Layout, Plant layout, 0-50 MGD plant.

The purpose of the work is the development of a test module conceptual design from which architect-engineer plans and specifications may be prepared for procurement and construction. The evaporator unit described employs the conventional multistage flash process. The plant consists of 39 stages, 36 recovery stages and 3 rejection stages, and operates with a maximum brine temperature of 250 deg F. Blowdown brine concentration ratio is 2.0. Concentration ratio of the brine circulated through the brine heater is 1.7. Design capacity is 50 mgd of potable water at 78 deg F. The test module width was influenced by the desire to be able to demonstrate in the module the same size brine circulation pump as selected for the 50 mgd design. Considering all factors led to the use of a 1/4 width test module.
W70-01703

OPTIMIZATION OF FLASH DISTILLATION PLANTS FOR SEA-WATER CONVERSION,
Haschinenfabrik Augsburg-Nuernberg A. G., Gustavsburg (West Germany).
For primary bibliographic entry see Field 07C.
W70-01705

AN ASSESSMENT OF VAPOR COMPRESSION DISTILLATION,
California Univ., Richmond.
B. W. Tleimat, E. D. Howe, and A. D. K. Laird.
Desalination 2, p 287-98, 1967. 12 fig, 6 ref.
Identifiers: *Compressors, *Vapor compression evaporation, *Vapor compressors, Bench scale, Component designs, Design data, Distillation processes, Falling film evaporation.

A description of tests and data are presented concerning vapor compression distillation. It is shown that the compression energy requirement for the vapor-compression cycle may be predicted from the isentropic compression work requirement. The compressor energy is a function of M (the circulation ratio, lbs brine/lbs product), and decreases with increasing M. The isentropic compression work is higher for a finite M than that required by the conventional compression cycle. Methods are presented for estimating the effects of salinity and other factors on compressor power requirements.
W70-01706

PREVENTIVE FOR SCALING AND CORROSION OF FLASH EVAPORATORS,
Tokyo Electric Power Corp. (Japan); Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 08G.
W70-01707

COMBINED SYSTEM FOR THE OPTIMUM SATISFACTION OF SIMULTANEOUSLY ARISING DEMAND FOR FRESHWATER AND ELECTRICAL POWER,
Hoterv, Budapest (Hungary).
For primary bibliographic entry see Field 08C.
W70-01708

STUDY OF THE BEHAVIOUR OF VARIOUS MATERIALS IN SEA WATER UP TO 150 DEG C,
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 08G.
W70-01709

THE CHARACTERISTICS OF DUAL PROCESS DISTILLATION PLANT COMBINING VAPOUR COMPRESSION AND MULTI-STAGE FLASH EVAPORATORS,
Atomic Energy Research Establishment, Winfrith (England).
F. C. Wood, and R. Herbert.
Preprint of Paper SM-113/44 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 23 p, 7 fig, 6 ref.
Identifiers: *Coupling (Reactor-desalting plant), *Dual-purpose plant, *Multistage flash distillation, *Vapor compression evaporation, Evaporators, Flash evaporation, Flowsheets, Heat exchangers, Heat transfer surfaces, Multiple effect distillation, Single-purpose plant, Thermodynamics, Turbines, Water costs estimate.

The relationship of energy demands and heat transfer surface for the vapor compression process are examined from the thermodynamic standpoint and compared with those of other evaporation processes. It is concluded that the greatest advantage in terms of heat transfer surface per unit of prime fuel is obtained when the vapor compression evaporator is coupled to the top end of the multistage flash plant either in single- or multi-effect. Various alternative coupling modes are considered, including the use of a secondary fluid in the vapor compression work cycle. Relative outputs of vapor compression and multistage evaporators depend primarily upon the type of heat source available and the efficiencies of the heat and work cycles. Typical figures are presented for various combinations using boilers/steam turbines, gas turbines, diesels and jet compressors. The principal secondary variables are operating temperature differences across the two kinds of evaporators. Power-to-water ratio may be increased economically by using a portion of the energy produced at the steam turbine to drive the vapor compression evaporator. The influence of the choice of principal variables, including turbine pass-out pressure, upon operating costs is illustrated for a nominal 300 mw (e) advanced gas cooled reactor operating in dual- and single-purpose modes.
W70-01710

THE STEAM-GENERATING HEAVY-WATER REACTOR IN DUAL-PURPOSE APPLICATIONS,
Atomic Energy Research Establishment, Winfrith (England).
For primary bibliographic entry see Field 08C.
W70-01711

SOME BASIC ASPECTS OF THE FLASH DISTILLATION PROCESS,
Heriot-Watt Univ., Edinburgh (Scotland).
A. N. Dickson, and J. K. Bradie.
Preprint of Paper SM-113/46 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1969. 18 p, 9 fig, 26 ref.
Identifiers: *Demisters, *Multistage flash distillation, *Two-phase flow, Entrainment, Evaporators, Experimental data, *Flash evaporation, Fluid flow, Hydraulic structures, Research results.

A report on MSF research at Heriot-Watt University. Part I discusses the problem of entrainment of water droplets in vapor streams and their removal by wire mesh type demisters. Methods of measuring droplet size-frequency spectra are given together with typical spectra obtained from an air-water analogue of pool boiling. Mesh demister performance is analyzed and collection efficiency of a wire discussed. Experimental measurements of dry pressure drop through demisters are given and a correlation derived from a simple physical model is suggested. The physical model is developed to provide a correlation between liquid and vapor flow rates at the point where flooding of the demister occurs, and this is compared with experimental results. Some discussion of wet pressure drop is also given. Part II presents experimental and analytical results of two-phase flashing flow in pipes and channels. The analysis is based upon a finite rate of vaporization model, which does not assume that thermodynamic equilibrium obtains, and allowance is made for variable vapor/liquid velocity ratios. Consideration is restricted to the two-phase flow regime in which the vapor is dispersed as bubbles throughout the liquid. The phenomenon of hydraulic jump in two-phase channel flow is discussed and both experimental and analytical results are given.
W70-01712

EXERGY LOSSES IN A FLASH EVAPORATOR,
Technische Hogeschool, Delft (Netherlands).
L. W. Koot.
Desalination 5, p 331-48, 1968. 8 fig, 7 ref.
Identifiers: *Multistage flash distillation, *Thermodynamic analysis, Distillation processes, Flash evaporation, Heat loss, Thermodynamics.

A thermodynamic explanation of the operation of a flash evaporator by the principle of exergy losses is of considerable importance, especially in the study of the desalination process. In a flash evaporator an amount of circulating heat to which additional energy is supplied is subjected to the irreversibilities of the installation. A calculation of the losses of exergy and measures of these irreversibilities, give information about the process details which are mainly responsible for the energy consumption. Assuming some simplifications, the numerical values of the loss of exergy are calculated for the special case of a ten stage once-through flash evaporator. It is found that the dominant losses are caused by the irreversibilities of the heat transfer from steam to brine and by the isenthalpic expansion of the brine between the flash chambers. Significant to cost reduction may be the need to supersede the flashing process by one involving less entropy production. This may be accomplished by (1) reducing losses in the water-steam separator, (2) restricting pumping power, (3) economical removal of incondensables.
W70-01713

UNITED KINGDOM DESALINATION RESEARCH AND DEVELOPMENT PROGRAM,
United Kingdom Atomic Energy Authority, Risley (England).
H. Kronberger.
Preprint of Paper SM-113/50 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 6 p.
Identifiers: *Development, Distillation processes, Freeze processes, Membrane processes, Multistage flash distillation, *Research, *Reviews.

In 1965 the Ukaea, on behalf of the UK government, assumed responsibility for research into development of methods of desalination of salt water. An initial three-year program costing $3 million brought close collaboration with industry on

processes including multistage flash distillation, electrodialysis, the secondary refrigerant processes and reverse osmosis. The program had two principal objectives - (1) to exploit the development potential of the multistage flash distillation process, and (2) to explore alternative methods of desalination which might supersede msf in the long term. In 1968 approval was given for expenditure of a further $9.6 million for the period 1968-71. Almost half of this will be used to finance agreed programs of work by the AEA with industrial collaborators. Project organization and current and proposed areas of research and development are outlined.
W70-01714

THE PHYSICS OF DESALINATION BY MULTI-STAGE FLASH DISTILLATION,
Glasgow Univ. (Scotland).
R. S. Silver.
J Brit Nucl Energy Soc 7 (1), p 36-42, 1968.
Identifiers: *Evaporator system design, *Physical properties, *Research, Bubble dynamics, Dynamic characteristics, Economic evaluations, Flash evaporation, Fluid dynamics, Performance ratio, Reviews, Stability analysis, Thermal properties, Vapor release rate, Water costs estimate.

The decision to utilize seawater conversion plants is based on economics. The costs involved are determined largely by knowledge of the related physical phenomena and by implementation of this knowledge. A review is presented of the major physical aspects and their interaction with plant design and cost. These aspects include bubble nucleation and growth, droplet formation, flashing temperature ranges, residence time, system stability and control, equilibrium time, and evaporation rate as related to thermal conductivity.
W70-01715

OPTIMIZATION OF MULTI-STAGE FLASH EVAPORATION PLANTS,
Alexandria Univ. (Egypt); and Atomic Energy Commission, Cairo (Egypt).
M. A. Mandil, and E. E. Abdel-Ghafour.
Preprint of Paper SM-113/67 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 25 p, 8 fig, 7 ref.
Identifiers: *Multistage flash distillation, *Parametric studies, *Thermodynamics, Brine concentration ratio, Design criteria, Distillation processes, Economic evaluations, Energy costs, Flash evaporation, Performance ratio, Thermodynamic analysis.

Principal optimization variables considered are number of stages, terminal temperature difference, performance ratio and concentration ratio. Interrelations between optimization variables are formulated by reference to interaction between thermodynamics and economics. A new concept of minimum-possible energy requirement is introduced, making it possible to account for the effect of brine concentration on amount of energy required and leading to a more accurate method of determining optimum concentration ratio. Thermal driving force function, providing a convenient interrelation between energy and surface requirements, is defined. The theory uses relative values of economic parameters rather than absolute values and, while current theories take economic parameters as constants, the proposed theory imposes no such restriction. As a result of its application, plots are furnished which can readily be used to determine optimum operating conditions represented in the concentration ratio, as well as design features such as number of stages, heating surface and energy requirement at optimum conditions.
W70-01716

DETERMINING THE OPTIMUM NUMBER OF STAGES OF THERMAL DESALINATION PLANT WITH SURFACE-TYPE EVAPORATORS,
Akademiya Nauk SSSR, Moscow. Moskovskii Inzhenerno-Fizicheskii Institut.
B. N. Golubkov, and A. I. Korneichev.
Thermal Eng, English Transl 14, p 69-72, 1967. 3 fig.
Identifiers: *Evaporator system design, *Evaporator-condenser system designs, *Vertical tube evaporators, Design, Distillation processes, Economic evaluations, Plant layout, Surface boiling.

An analytical method is developed for determining the optimal number of stages in desalination plants with surface-type evaporators. The method utilizes as input data on water and stream properties, operating temperatures and flow rates, condenser surface areas and performance factors, on stream time fraction, heat input, and costs of capital equipment, energy, amortization, labor, and maintenance.
W70-01717

THE SELECTION OF NUCLEAR POWER AND DESALINATION PLANTS FOR AUGMENTING EXISTING WATER RESERVES,
Associated Nuclear Services, London (England).
For primary bibliographic entry see Field 03E.
W70-01718

A SURVEY OF PRESENT AND FUTURE DESALINATION PROCESSES,
Atomic Energy Research Establishment, Harwell (England).
K. D. B. Johnson.
J Brit Nucl Energy Soc 7 (1), p 27-35, 1968. 8 fig, 21 ref.
Identifiers: *Economic evaluations, *Reviews, *Water costs estimate, Distillation processes, Electrodialysis process, Freeze processes, Membrane processes.

A summary of the trend evident in flash distillation plant development and against that background a discussion of the potential of competitive or alternative processes, particularly freezing, reverse osmosis, and electrodialysis both in the UK and overseas. At present flash distillation is in a commanding position, but there are reasons for believing that other processes are capable of development to the point where they will replace distillation in many circumstances.
W70-01719

THE NEED FOR DESALINATION,
Water Research Association, Medmenham (England).
R. G. Allen.
J Brit Nucl Energy Soc 7 (1), p 21-26, 1968. 4 fig, 5 ref.
Identifiers: *Multistage flash distillation, *Reviews, *Water utilization, Base-load, Distillation processes, Water sources, Water storage.

Desalination is in the early stages of its development as a water resource. It is already making its contribution as a straight addition to the water supply in cases where there is an absolute water deficiency, and it is now coming into use in areas where further conventional water supplies would be expensive, as the most economical supplement to existing systems. In the United Kingdom desalination as a base-load resource is considered unlikely before 1990, but its earlier application for peak load operation is expected. The world demand for desalination plants is thus expanding rapidly. The most successful process for seawater conversion remains multistage flash distillation, judged on both technical and economic grounds, and this advantage is likely to be retained for some time.
W70-01720

CONDENSER TUBE MATERIALS FOR SEA-WATER SERVICE,
Naval Ship Research and Development Lab., Annapolis, Md. Annapolis Div.
For primary bibliographic entry see Field 08G.
W70-01721

EVALUATION OF BRINE DESULFATING PROCESS AS APPLIED TO DESALINATION PHASE 1,
Catalytic Construction Co., Philadelphia, Pa.
For primary bibliographic entry see Field 05D.
W70-01722

DEVELOPMENT OF AN ANALYTICAL MODEL OF A FLASH STAGE - PART 1,
Connecticut Univ., Storrs.
For primary bibliographic entry see Field 08B.
W70-01723

GAS-TURBINE AND DIESEL-DRIVEN VAPOR-COMPRESSION DESALTING PLANTS,
Oak Ridge National Lab., Tenn.; and Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 08C.
W70-01724

DESIGN OF A 250-MGD VERTICAL-TUBE EVAPORATOR FOR SEAWATER DESALTING,
Oak Ridge National Lab., Tenn.
R. P. Hammond, I. Spiewak, and E. C. Hise.
IN Proc Western Water Power Symp, Los Angeles, Apr 1968. Western Periodicals, North Hollywood, Calif, 1968. p C-51-57, 3 fig, 6 ref.
Identifiers Conceptual design, Falling film evaporation, Flash evaporation, Vertical tube evaporators, 51-250 MGD plant, Capitalized costs, Concrete construction, Dual-purpose plant, Dual-purpose plant economics, Economic evaluations, Energy costs, Fabrication methods, Fixed charge rate, Heat transfer surfaces, Multiple effect distillation, Multistage flash distillation, Nuclear energy sources, Operating costs, Performance ratio, Synthetic resinsPlastics, Thermodynamics.

Under OSW sponsorship, ORNL prepared a conceptual design of a 250-mgd plant combining 15 effects of vertical tube, falling film evaporator with 50 stages of flash evaporator feed heating. The vertical tube surface is of the doubly fluted type, providing heat fluxes 2 to 3 times those of smooth tubes, and permitting design of a compact, closely coupled evaporator configuration. Additional economies are achieved by use of concrete structures and plastic materials. A preliminary investigation of several proposed processes, heat transfer surfaces, plant configurations, materials, and fabrication methods was made in sufficient depth to select those best suited to this specific set of circumstances. The combined multiple-effect multistage flash process chosen is thermodynamically more efficient (provides more water for a given operating temperature range) than either process on its own. Choice of a performance ratio of 13 lb/1000 btu was predicated upon the evaporator being coupled to a nuclear generator plant for the simultaneous production of water and power. The paper presents estimated capital and operating costs over a range of energy costs, fixed charge rates, and performance ratios. The conceptual design presents a strong economic incentive to pursue the development of vertical tube evaporator technology.
W70-01725

ADVANCES IN VERTICAL TUBE PLANTS FOR SEA WATER DISTILLATION,
Stearns-Roger Corp., Denver, Colo.
D. D. Kays.
IN Proc Western Water Power Symp, Los Angeles, Apr 1968. Western Periodicals, North Hollywood, Calif, 1968. p C-59-85, 6 fig.
Identifiers: *Falling film evaporation, *Multiple effect distillation, *Multistage flash distillation, *Vertical tube evaporators, Distillation processes, Dual-purpose plant, Flash evaporation, Heat recovery system.

A brief history of modern distillation development is combined with a summary of the current state of the art relative to the multiple-effect-vertical-tube seawater distillation process. Advanced designs possible with (1) extended surface falling film

tubes and (2) multiple stage flash heat recovery within each effect are developed analytically and described qualitatively. Progress design considerations for utilizing these concepts are presented. The overall technical advantage of the vertical tube distiller is shown by a direct comparison to the MSF recycle plant. The ease with which the vertical tube plant may be designed for large capacities is discussed. A few of the desirable features of coupling a VTE distiller to a nuclear fuelde power plant are presented.
W70-01726

CUPRO NICKEL ALLOYS FOR DESALINATION PLANTS,
American Brass Co., Waterbury, Conn.
For primary bibliographic entry see Field 08G.
W70-01727

THE CUPRO-NICKELS IN DESALINATION PLANT,
International Nickel Co., Ltd., London (England); and International Nickel Co., Inc., New York.
For primary bibliographic entry see Field 08G.
W70-01728

CALCIUM SULFATE SCALING IN SALINE WATER DISTILLATION,
Monsanto Research Corp., Everett, Mass.
For primary bibliographic entry see Field 05D.
W70-01729

ION EXCHANGE PRE-TREATMENT FOR SEA WATER DESALINATION PLANTS,
Maschinenfabrik Augsburg-Nuernberg A.G., Gustavsburg (West Germany).
For primary bibliographic entry see Field 05D.
W70-01730

STUDY OF TWO-PHASE METASTABLE FLOW,
Foster Wheeler Corp., Carteret, N.J.
R. W. Bryers, and W. S. Hsieh.
OSW R and D Progr Rept No 234, Nov 1966. 150 p, 46 fig, 4 tab, 20 ref.
Identifiers: *Fluid flow, *Two-phase flow, Flow distribution, Fluid dynamics, Fluid mechanics, Multistage flash distillation, OSW sponsored, Turbulent flow, Water flow.

An experimental study was made to determine the flow rate of saturated water through short tubes of various lengths and diameters. Tubes of both rounded and sharp edge entrances were tested in the horizontal and vertical positions. It was found that the fluid passed through the aperture in the metastable state. Critical flow rates existed for all test runs. The critical mass flow rates were dependent on both the length and the diameter of the tubes instead of the length to diameter ratio alone. The critical mass flow rate was found to be proportional to the ratio of the specific volume of the vapor and liquid to the .630 power and the aperture volume to the .163 power. Test results were analyzed and correlated. The flow patterns within the test tube were photographed by a high-speed movie camera to obtain a qualitative interpretation of the two-phase fluid flow.
W70-01753

SECOND REPORT ON THERMOPHYSICAL PROPERTIES OF SALINE WATER SYSTEMS,
Monsanto Research Corp., Everett, Mass.
B. M. Fabuss, and A. Korosi.
OSW R and D Progr Rept No 249, 1967. 50 p, 18 tab, 5 fig, 36 ref.
Identifiers: *Physical properties, *Viscosity, OSW sponsored, Thermal properties, Thermodynamics.

Viscosities of water solutions of sodium chloride, potassium chloride, magnesium sulfate, and sodium sulfate and their ternary combinations were measured in the 25-150 deg C temperature range. The concentration ranges covered corresponded to seawater and its concentrates up to a concentration factor of five. On the basis of this work a new correlation was developed for calculating the dynamic viscosity of liquid water. Preliminary work on thermal conductivity measurements is outlined. This is continuation of work covered in CSW R and D nos. 136 and 189.
W70-01754

INVESTIGATION OF CORROSION IN HOT SEA WATER IN AN EXPERIMENTAL LOOP APPARATUS,
Battelle Memorial Inst., Columbus, Ohio.
F. W. Fink, E. L. White, and W. K. Boyd.
OSW R and D Progr Rept No 225, Dec 1966. 30 fig, 9 tab, 3 ref.
Identifiers: *Corrosion tests, *Low alloy steels, *Nickel alloys, *Pitting (Corrosion), *Stainless steels, *Titanium, *Tubing (Metal), Aluminum alloys, Carbon steels, Concentration cell corrosion, Deaeration, OSW sponsored, Removal from feedwater, Carbonate, Scale prevention, Stress corrosion, Temperature control, Velocity control, Wrightsville beach plant.

An experimental program was undertaken at Wrightsville beach to study scale control and corrosion of metals in deaerated seawater to 300 deg F. Test materials included carbon and low-alloy steels, stainless steels, and nickel- and aluminum-base alloys. Performance of loop-component materials is given. Acid treatment to remove carbonate ion resulted in minor scaling at 250 deg F. In seawater at neutral pH, corrosion was minimized under carbonate-free conditions. All metals showed general or localized attack under certain conditions. Corrosion rate of steel was accelerated by temperature even at low oxygen levels. Low-alloy steels exhibited more tendency to pitting. Straight chromium steels were subject to severe pitting. Austenitic stainless steels and some high-nickel alloys showed excellent resistance at velocities of 5 ft/sec or greater. Under stagnant conditions or at crevice areas, however, pitting was encountered. At 250 deg F aluminum alloys performed poorly after two weeks. Titanium heat-exchanger tubing exhibited excellent resistance but was prone to crevice attack. Hastelloy C performed well as equipment components except in the pump where cracking occurred, presumably due to weld repairs or faulty design. Corrosion rates for test materials are given as a function of temperature, time, and velocity.
W70-01755

THE FRENCH PROGRAM FOR THE DESALINATION OF SEAWATER,
Centre d'Etude de l'Energie Nucleaire, Grenoble (France).
P. Balligand.
Preprint of Paper SM-113/72 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 7 p.
Identifiers: France, Research, Reviews.

A brief outline of the areas of desalination research and development under investigation by various industrial and governmental groups in France. A large portion of the work is being done under the direction of the French AEC. (In french)
W70-01756

FIFTEEN YEARS OF PROGRESS,
Department of the Interior, Washington, D.C.
M. N. Edwards.
Preprint of Paper SM-113/53 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 9 p.
Identifiers: *Reviews, Agriculture, Distillation processes, Dual-purpose plant, Energy sources, Freeze processes, Industries, Membrane processes, Nuclear energy sources, Research results, Single-purpose plant.

The U.S. Congress in 1952 enacted legislation authorizing a research program for development of practicable low-cost means of producing from seawater, or other saline waters, water of a quality suitable for agriculture, industrial, municipal and other beneficial consumptive purposes. With an initial appropriation of $175,000, the Secretary of the Interior established the Office of Saline Water. The U.S. Desalting Program has received continuing and increasing support by Congress. In 1968, the OSW appropriation for research and development activities was $24.5 million, bringing the total U.S. Government investment in desalting technology to more than $130 million. This paper reviews the status of desalting technology when the U.S. program was initiated and reports on major activities achieved since then. The current status of freezing methods and membrane processes is discussed, but major emphasis is on the present state-of-the-art of distillation techniques and the utilization of nuclear reactors as an energy source for multimillion gallons-per-day water-only or dual-purpose power and water plants.
W70-01757

UNITED KINGDOM APPROACH TO DESALINATION AND NUCLEAR POWER,
Atomic Energy Authority, Risley (England).
H. Kronberger.
Preprint of Paper SM-113/71 Presented at IAEA Symp Nucl Desalination, Madrid, Nov 18-22, 1968. 7 p.
Identifiers: *Dual-purpose plant, *Multistage flash distillation, Flash evaporation, Freeze processes, Membrane processes, Pilot plant operations, 0-50 MGD plant.

The first phase of the UK National desalination program was initiated in 1965 for a 3-yr period with a government appropriation of $3 million. Responsibility was vested in the Ukaea, with two objectives - (1) to further development of the multistage flash process and (2) to explore alternative processes which might supersede MSF. The first objective was pursued in close collaboration with Weir Westgarth Ltd., while the second was begun solely as a Ukaea responsibility, with alternatives reduced to freezing, electrodialysis, and reverse osmosis. Industrial collaborators have been named for these processes. Most of the first-phase budget was directed toward MSF development. A new seawater experimental establishment was constructed by Weir Westgarth at Troon, Scotland, with facilities to test plant features up to 10 MGD in size. Large-scale facilities are also being operated, or are under construction, in industrial laboratories for electrodialysis and freezing. A second 3-yr program was authorized in 1968, at a cost of $9.6 million. A new contract is being placed with Water Research Association to extend their work on conjunctive use of desalination and conventional water supply to specific problems of such use in other countries.
W70-01758

EVAPORATION COEFFICIENT OF LIQUIDS,
Rochester Inst. of Tech., N.Y.
J. R. Maa.
Ind Eng Chem Fundamentals 6, 504-18, 1967. 8 tab, 24 fig, 15 ref.
Identifiers: *Film evaporation, *Heat transfer, *Heat transfer coefficient, Conduction (Heat), Heat exchangers.

Thermal gradient calculations have been made in an attempt to place the technique of the jet tensimeter on a quantitative basis. Families of curves have been derived with which experimental data can be compared. Using the jet tensimeter, evaporation rates of water, isopropyl alcohol, carbon tetrachloride, and toluene have been examined at various liquid temperatures, times of exposure, and back pressures of vapor. The experimental results agree satisfactorily with the thermal gradient calculations, making the assumption that the evaporation coefficient is unity. This shows that there is little or no resistance to molecules crossing the vapor-liquid interface in addition to the natural resistance imposed by the gas laws. As a corollary, when any vapor molecule strikes at the interface,

the chance of failing to cross is small. No significant difference in the behavior of evaporation due to the difference in molecular structure or chemical properties was observed.
W70-01759

PRACTICAL CONSIDERATIONS IN DESALTING AND ENERGY DEVELOPMENT AND UTILIZATION,
Atomic Energy Commission, Washington, D.C.
J. T. Ramey.
Preprint of Paper SM-113/70 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 16 p, 7 ref.
Identifiers: *Dual-purpose plant economics, *Nuclear energy sources, *Water utilization, Base-load, Dual-purpose plant, Economic evaluations, Energy sources, Nuclear desalination, Peaking power, Water costs estimate.

The combination of nuclear power and desalting in large dual-purpose installations tends to maximize economics inherent in large-scale operation. Water costs of 30-40 cents/1000 gal from large (100 mgd-300 mwe) plants appear to be achievable in plants of the near future. Technological advances will further reduce this cost, making the long-range economic outlook for large-scale desalting quite favorable. Combining production of water and electric power requires planning for development of both resources. Various approaches to unified resource development may be taken, including consideration of peak vs base load power requirements, use of hydro-power to supplement power from the dual-purpose plant in peak periods, and ability to store desalted water in existing facilities. These factors also introduce a need to carefully assess values assigned to the two products. Application of nuclear desalting to the energy center concept is essentially tailored to special problems and opportunities of developing nations. Factors which must be considered are complex and diverse, including such elements as water and power demands, agricultural production and marketing, industrial capabilities and the market for manufactured products, as well as financial and even sociological considerations.
W70-01760

VALUE TO AGRICULTURE OF HIGH-QUALITY WATER FROM NUCLEAR DESALINATION.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 03C.
W70-01761

THE RESULTS OF SOVIET RESEARCH ON DESALTING OF WATER,
Desert Inst., Ashkhabad (USSR).
M. V. Kolodin.
Translation from Problemy Osvoyeniya Pustin No 6, p 33-41, 1967. Soviet Geography: Review and Translation, Vol 9, No 6, June 1968, p 493-502, 1 tab, 16 ref.

Descriptors: *Desalination, *Desalination plants, *Scaling, *Arid lands, *Economics, Desalination processes, Distillation, Freezing, Flash distillation, Electrodialysis, Solar distillation, Boiling, Saline water, Costs.
Identifiers: *USSR, Natural freezing.

The author reviews saline-water conversion progress and lists plants installed or planned for installation in the USSR. The technical characteristics and costs per unit of converted water are summarized. Costs range from an estimated 0.06 rubles per cubic meter for a dual purpose atomic energy plant under construction in the Kazakh SSR to 14.60 rubles per cubic meter for a small straight distillation plant built in 1907 in Turkmenia. The conclusion is that considerable success has been achieved in design of large scale plants but a great need exists for small stationary and portable units for use in rural areas. (Crouse-Arizona)
W70-01824

FLOW THROUGH POROUS MEDIA: A STATISTICAL APPROACH,
Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
Ruth H. Aranow, and Louis Witten.
Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402 - Price $0.40. Office Saline Water Res and Develop Progr Rep No 354, Aug 1968. 31 p, 19 ref, 1 append. Contract No 14-01-0001-411 OSW.

Descriptors: *Ion transport, *Membrane processes, *Flow, *Porous media, *Statistical models, Statistical methods, Membranes, Fluid friction, Immiscibility, Equations, Thermodynamics, Hydrodynamics, Desalination processes, Desalination.
Identifiers: Immiscible fluids, Miscible fluids, Multicomponent fluid systems, Irreversible processes, Charged membranes.

The statistical mechanical treatment of ion transport processes in multicomponent fluid systems developed by Bearman and Kirkwood is adapted to include flow in porous media. The rigid medium is treated as if it were one of the components of the multicomponent fluid system, but it is constrained by an external force which prevents its motion. Various equations are presented which clarify the problem of 'fingering' at the displacement front between two immiscible fluids in the membrane. The equations lead under restrictive conditions to the same results as the theoretical developments of Scheidegger and Brinkman. New equations for flow in miscible multicomponent systems are suggested. Darcy's constant is given a statistical interpretation in terms of pair correlation functions through the definition of the friction coefficient. The development also serves as a connecting link between hydrodynamics in porous media and the thermodynamics of irreversible processes. (Carstea-USGS)
W70-01886

RATIONALE FOR LOW-COST NUCLEAR HEAT AND ELECTRICITY,
Oak Ridge National Lab., Tenn.
J. A. Lane.
In: Abundant Nuclear Energy, Proc Sym Gatlinburg, Tenn, Aug 1968. Published in AEC Symp Ser 14, (CONF-680810), p 3-28, 1969. 11 fig, 15 tab, 9 ref.
Identifiers: *Energy costs, *Nuclear energy sources, Breeder reactors, Converter reactors, Energy sources, Process heat.

A review of the historical use of energy reveals that the amount used by any one person is strongly dependent on its cost. An extrapolation of this trend to the year 2000 results in a projection that the average delivered cost of electricity in the U.S. will decrease to 3.5 mills/kwhr and the per capita consumption will increase to 30,000 kwhr per annum. Achieving such low-cost power will require significant improvements in generating costs, as well as reductions in transmission and distribution costs. This paper describes in some detail how this might be done. Generating costs, for example, will be reduced to about 1.5 mills/kwhr through the development of very large (i.e., 5000-mwe) high-performance breeders served by large-scale fabrication and processing plants. Nuclear plants with such characteristics appear to be an achievable end product of the present lines of nuclear power development. If the sale price of electricity is properly assigned to various types of customers as a function to the amount used by each customer, an average delivered price of 3.5 mills/kwhr would result in a rate of 5.5 mills/kwhr for residences and 1.5 mills/kwhr for industries. These prices will be low enough to stimulate an electricity binge on the part of both the household user and new industrial users.
W70-01946

INTEGRATION OF WATER REQUIREMENTS IN ARID AREAS BY MEANS OF DUAL-PURPOSE PLANTS FOR THE DESALINATION OF SEA WATER AND PRODUCTION OF ELECTRIC POWER. OPERATIONAL RESULTS OBTAINED BY THE ITALSIDER PLANTS AT TARANTO, ITALY (IN ITALIAN),
Societa Italiana Implanti, Genoa.
G. Carolei, C. Franzosi, and M. Jemma.
Preprint of Paper SM-113/3 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 21 p, 3 fig, 6 ref.
Identifiers: *Dual-purpose plant, *Flash evaporation, *Operating experience, Corrosion problems, Dual-purpose plant economics, Energy sources, Operating costs, Scaling, Turbine driven pumps, Turbine-generators.

The plants are considered in a dual-purpose context and the relevant heat cycle efficiencies are considered. An overall increase in efficiency is noted when compared with plants for desalination only. An economic advantage lies in the possibility of selling the electrical power produced at the same time as the fresh water. These plants are thus well suited to regions of rapid industrial and social development which are also near large settlements of the agricultural and residential type. The large flash evaporation units installed in the Italsider iron and steel works at Taranto can also be considered as dual-purpose plants since they utilize exhaust steam which has already undergone two enthalpy steps, first in the turbo-alternators at the thermoelectric station, and then in two turbopumps. In connection with the latter installation, the authors analyze the operational results and steps taken to solve problems of scaling and corrosion, as well as problems caused by the presence of metal ions in solution in the product water, some of which is intended for use in high-pressure boilers.
W70-01947

INTEGRATING DUAL-PURPOSE PLANT FOR POWER AND WATER PRODUCTION INTO AN EXISTING ELECTRICITY SUPPLY SYSTEM,
Electro-Watt Engineering Services Ltd., Zurich (Switzerland).
K. Goldsmith.
Preprint of Paper SM-113/42 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 10 p, 3 fig.
Identifiers: *Dual-purpose plant, *Load following, *Peaking power, *Product ratio, Base-load, Dual-purpose plant economics, Economic evaluations, Energy sources, Load factor, Nuclear energy sources, Plant factor, Process heat, Reactor power cycle, Steam cycle, Water storage.

The operating regime demanded of various types of generating plant is illustrated with reference to daily and annual load curves of typical supply systems in areas of potential water shortage. It is shown that, if a particular dual-purpose plant exceeds a critical size, which may be less than its optimum size, it will be of maximum value to the system if its power output can be cyclically or seasonally varied to suit system requirements. Water production costs from this plant will then be lowest. Thus, with a constant amount of heat produced by boiler or reactor, the heat/power ratio on the generating side may have to be altered, in the short term to keep it in step with the system load curve and in the long term to accord with the changing position of the power plant in the general order of merit of all other generating plant in the system. Water is then produced counter-cyclically, i.e., at a maximum rate at times of minimum power demand, any temporary water surplus being stored. Steam cycles for varying heat-power ratios are briefly reviewed and their economics discussed.
W70-01948

COMBINATION OF HIGH-TEMPERATURE REACTOR WITH A CLOSED-CYCLE GAS TURBINE AND DESALINATION PLANT,
Gutehoffnungshuete Sterkrade A.G., Oberhausen (West Germany).
A. Ehret, H. Sonnenschein, and E. Bohm.
Preprint of Paper SM-113/6 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 13 p, 6 fig, 5 ref.

Identifiers: *Converter reactors, Process heat, *Turbine operation, Design, Dual-purpose plant, Dual-purpose plant economics, Multistage flash distillation, Reactor power cycle, Thermodynamic analysis, Turbines.

High-temperature reactors with closed-cycle gas turbines are suitable for combination with a desalination plant, as even in the course of normal operation waste heat is partly available at a sufficiently high temperature level to permit its use as process heat. To increase the water production in a dual-purpose plant several methods are available to esstentially increase the quantity of process heat in a closed gas turbine cycle. Which of these methods is most economic depends on several operating conditions. In some cases, the loss of electric power with increasing process heat supply is extremely low. Therefore, the costs of this additional heat are also extremely low and water production in such a plant is very economical. When combining a gas turbine circuit with a multistage flash evaporation plant, some special conditions of adaptation arise because the temperature of the working fluid is not constant during reheat extraction. From this a strong dependence between fresh-water output, maximum brine temperature, specific heat consumption in the desalination plant and process heat supply from the gas turbine plant results if the most economic design of dual-purpose plant is desired.
W70-01949

THE SODIUM-COOLED FAST BREEDER REACTOR AS A HEAT SOURCE FOR DESALINATION PLANTS,
Bechtel Corp., San Francisco, Calif.
R. A. Langley, and R. L. Clark.
Preprint of Paper SM-113/40 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968.
Identifiers: *Breeder reactors, *Economic evaluations, *Liquid-metal fast-breeder reactors, Coupling (Reactor-Desalting Plant), Design, Dual-purpose plant economics, Single-purpose plant economics, 0-500 MW (E) reactors, 500 plus MW (E) reactors.

Design evolution of the sodium-cooled fast breeder reactor as a dual-purpose or single-purpose energy source as it is affected by application to desalination is considered. Technical problems treated include selection of plant operating temperature, the steam cycle for the dual-purpose plant, ratio of electric power output to process steam, steam generator design, the need for a tertiary water loop between the liquid metal and the brine heaters, and containment design. These problems are discussed in terms of the 250-500 mw (e) plants in preliminary design in the U.S. and the 1000 mw (e) plants being studied as part of the USAEC Liquid Metal Fast Breeder Reactor Program. Evaluations of power and water costs for dual- and single-purpose plants as functions of plant size are made. Estimates of possible future power and water cost reductions as a result of design evolution and the development of a viable industry are also included.
W70-01950

PUMPED STORAGE - THE HANDMAIDEN OF NUCLEAR POWER,
Northeast Utilities Service Co., Hartford, Conn.
S. R. Knapp.
IEEE Spectrum 6 (4), p 46-52, 1968. 3 fig, 1 ref.
Identifiers: *Applications of nuclear energy, *Pumped storage, *Reviews, Base-load, Economic evaluation, Electrical System designs, Load factor, Northeast United States, Peaking power, Spinning reserve, Systems engineering.

The power companies of the New England States, where fossil fuel cost is high, have determined that low-variable-cost nuclear generation is desirable for this region. The construction of pumped-storage hydro plants, favored by the topography of the area, will offset the relatively high fixed costs of nuclear plants by maximizing the capacity-use factor of the nuclear facilities and thereby minimizing the total cost per unit of energy output. This combination provides efficient base load, economical peaking capacity, and effective spinning reserve, along with many recreational and other social benefits.
W70-01951

PRESSURIZED-WATER REACTORS FOR NATURAL AND ENRICHED URANIUM,
Siemens A. G., Erlangen (West Germany).
B. C. Drude, and F. H. Rohl.
Preprint of Paper SM-113/7 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 19 p, 6 fig, 6 ref.
Identifiers: *Dual-purpose plant, *Dual-purpose plant economics, *Nuclear energy sources, *Pressurized-water reactors, Energy sources, Heavy-water reactors, Turbine operation, Turbines.

Pressurized-water reactors are particularly well suited for high-capacity desalting plants. The heavy water and light water pwrs developed by Siemens Company represent two modifications of a common line. Reactors of either type with capacities up to 600 mw (e) in steel or concrete pressure vessels are available. Nuclear dual-purpose plants for electric power and process steam generation are rapidly gaining in importance. Technical and economic characteristics of high-powered units as required by the chemical industry have been studied for various flow schemes and ratings. Advantages and disadvantages of the back-pressure turbine cycle, offering the highest water-to-power ratio, are examined on the basis of realistic operating conditions. The economy of the plants may be improved by increased power production and adoption of suitable flow schemes. The advantages and disadvantages incurred by an extraction turbine or by a combination of back-pressure and condensing turbines are discussed. Specific investment and production costs of power and process steam are illustrated. For any particular case the two main parts of a dual-purpose plant may be chosen from among reactors of different design characteristics, and evaporators of different origin.
W70-01952

TECHNICAL AND ECONOMIC ASPECTS OF MEDIUM-POWER PLANTS FOR THE COMBINED PRODUCTION OF ELECTRICAL POWER AND DESALINATED WATER, USING VULCAN REACTORS AND LTV UNITS (IN FRENCH),
Societe Belge pour l'Industrie Nucleaire, Brussels; and Universal Desalting Corp., New York.
P. Maldague, C. Descamps, W. Debay, A. Paquet, and W. Bongard.
Preprint of Paper SM-113/17 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 19 p, 9 fig, 8 ref.
Identifiers: *Duel-purpose plant economics, *Vertical tube evaporators, Duel-purpose plant, Economic evaluations, Fixed charge rate, Nuclear energy sources, Pressurized-water reactors, Water costs estimate, 0-3000 MW (T) Reactors, 0-50 MGD Plant.

The technical and economic aspects of a dual-purpose plant are described. The plant couples a 280 MW (T) pressurized water reactor of the vulcan type with an LTV (Long Tube Vertical) desalination unit. The combination will produce 61 MW (E) and 24 MGD of product water. If power is assumed to be sold at 8 mills/kwh and a fixed charge rate of 11% is used, product water is estimated to cost 51.1 cents/1000 gal. If a fixed charge rate of 6% is assumed, the cost of water decreases to 40.1 cents/1000 gal.
W70-01953

ASPECTS IN DEVELOPING SEA WATER FLASH-DISTILLATION PLANT TO NUCLEAR-HEATED PLANT ON THE BASIS OF EXPERIENCE GAINED IN THE DESIGN, START-UP AND OPERATION OF SUCH INSTALLATIONS,
Atlas-Mak Maschinenbau G.m.b.H., Bremen (West Germany); and Fried-Krupp, Essen (West Germany). Zentralinstitut fuer Forschung und Entwicklung.
H. Laban, and W. Hohenhinnebusch.
Preprint of Paper SM-113/8 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 30 p, 12 fig, 4 ref.
Identifiers: *Corrosion control, *Dual-purpose plant economics, *Energy sources, *Operating experience, Corrosion, Distillation processes, Dual-purpose plant, Evaporators, Flash evaporation, Fossil fuels, Multistage flash distallation, Nuclear energy sources, Turbines, 0-50 MGD plant.

In 1965 the first major desalination plant of German design and with evaporators of German manufacture was built in Ceuta on the North African coast. The experience of construction, start-up, and several years of operation of the 1 MGD, 5000 KW (E) plant is described. Layout of the plant (flash evaporators arranged in two 24-stage blocks of 500,000 GPD each) and design of components and their resistance to corrosion are explained. Based on experience gained from this plant and numerous smaller installations, concepts for development of large-scale plants in combination with nuclear power stations are outlined. The possibility of combining a flash distillation plant with a gas turbine power station because of the cheap supply of waste heat is discussed. Cost aspects of such a dual-purpose installation are shown with reference to the various cycles on the basis of results obtained from different calculations.
W70-01954

HIGH-TEMPERATURE DESALINATION PLANTS FOR NUCLEAR POWER STATIONS,
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
R. A. Tidball, and J. G. Gaydos.
Preprint of Paper SM-113/26 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 19 p, 11 fig, 5 ref.
Identifiers: *Multiple effect distillation, *Multistage flash distillation, *Water costs estimate, Wrightsville Beach Plant, Capitalized costs, Condensers, Energy costs, Fixed costs, Scale prevention, Scaling.

The maximum temperature to which brine can be heated in a multistage flash plant affects both capital costs and energy costs charged to the product water. It was demonstrated at the DSW east coast test facility that seawater can be treated with sulphuric acid and heated in a once-through plant to 300 deg F without scale formation in the condenser tubes. Scaling will occur at temperatures above 270 deg F when this seawater is recirculated with or without concentration. A combination of a once-through high-temperature effect with either a single-effect multistage flash plant (SEMS) or a multieffect multistage (MEMS) flash plant can be utilized to reduce both capital cost and energy charges. Purity of product water from most MSF plants varies from 5 to 100 PPM TDS. Purer water (down to 1 PPM) can be made at an increase in capital cost. Capital charges, energy charges and chemical charges are compared for 150 MGD plants using the SEMS, MEMS and the once-through topping plant in combination with both. The cost of water is presented based on these adaptations to the MWD study.
W70-01955

OPTIMUM BRINE HEATER STEAM TEMPERATURE ON MSF EVAPORATOR COUPLED WITH FOSSIL AND NUCLEAR FUELED POWER PLANTS,
GHH-Man Technik, Essen (West Germany).
B. Kunst.
Preprint of Paper SM-113/9 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 13 p, 16 fig, 5 ref.
Identifiers: *Brine heaters, *Dual-purpose plant economics, *Multistage flash distillation, *Pres-

surized-water reactors, Computerized design, Coupling (Reactor desalting plant), Economic evaluations, Energy sources, Single-purpose plant economics, Turbines.

The results of a computerized optimization study are presented in graphical form. Neither the computer program nor its flowsheet is given. Assumptions include 13% fixed charge rate, 7000 hours operation per year, fuel oil at 32 cents/MBTU, nuclear heat about 14.6 cents/MBTU, and terminal temperature difference of 4 deg C. Heat sources considered include a pressurized water reactor with a steam turbine, a high-temperature gas reactor with a gas turbine, and an oil-fired boiler with a steam turbine. Both single- and dual-purpose plants are considered. Optimization curves show the influence of the process steam temperature, the influence of the water-to-power ratio, the influence of capacity, and the water and power prices resulting from the optimizations. On the basis of the assumptions made, the high-temperature gas reactor is suitable for dual-purpose plants up to a water-to-power ratio of liters/KWH and the PWR system up to 140 liters/KWH depending upon capacity. In all cases a marked trend is noted towards process steam temperatures over 130 deg C.
W70-01956

HOT BRINE ENERGY STORE,
Aktiebolaget Atomenergi, Stockholm (Sweden).
P. H. Margen.
Energy Intern 6 (5), p 16-20, 1969. 8 fig, 1 ref.
Identifiers: *Peaking power, *Steam cycle, *Thermal-hydraulic design, *Water storage, Brine flow, Brine system designs, Dual-purpose plant economics, Pumped storage, Turbine operation.

One of the cheapest methods of energy storage is the storage of warm water at moderate pressures. In a combined electricity and desalting scheme, hot brine provides a convenient means of storing energy. Using a technology developed for district heating schemes, hot brine can be stored in the upper part of a storage accumulator and cooler brine in the lower part. When the brine accumulator is charged with heat, hot water is fed in at the top and cooler water is discharged at the bottom, so that the level subdividing the water regions at the two temperatures gradually falls. During discharge, the flow is reversed. The accumulator can be charged by the use of bled-off steam during off-peak electricity periods, thus reducing electricity generation at such times. It can be discharged at periods of peak electricity demand, allowing the turbine to operate without bled steam as a pure condensing turbine, producing a maximum amount of electrical power. Thus the electricity output can be varied over a certain range, while the nuclear steam generating unit and desalting unit operate continuously at constant full load. Preliminary calculations indicate that such operation would result in significant savings even though the large accumulator would require a large investment.
W70-01957

SOME FEATURES REQUIRED OF NUCLEAR REACTORS FOR DUAL-PURPOSE WATER/POWER PRODUCTION,
United Kingdom Atomic Energy Authority, Risley (England).
H. Kronberger.
Preprint of Paper, LAEA Symp Nucl Desalination, Madrid, Nov 18-22, 1968. 7 p.
Identifiers: *Dual-purpose plant economics, *Economic evaluations, *Load factor, Amortization criteria, Base-load, Dual-purpose plant, Peaking power, Thermodynamic analysis, Water costs estimate.

Of paramount importance in determining the economics of dual-purpose operation is maintenance of high load factor for the entire life of the complex. A new approach to reactor operation with a dual-purpose function is outlined. The background, technical features, and operating experience of UK-designed reactors (AGR, SGHWR, HTR, PFR) are outlined. Nuclear powered desalting plants might best be operated as water producers rather than power units. As water producers, they could take advantage of the 90% availabilities of British nuclear reactors. As an example, a dual-purpose 200 MW (E), 120 MGD SGHWR plant was examined. With 10% capital interest, a 25-year amortization period, and an average load factor of 75%, water costs were 55.4 cents/1000 gal with an electricity credit of 6.6 mills/kwhr. On the theory that such a plant could have a 90% availability, continuing operation at 90% load factor was considered even with the electricity part of the plant relegated to a position of lower importance, when it would normally be shut down. An extreme case considered is that of dumping the high-pressure steam, but keeping the desalting plant in operation. By doing this the water production is increased by 20% over 75% load factor operation with a total operating cost increase of only 5%. Water costs drop from 55.5 cents/1000 gal to 48.6.
W70-01959

THE MAIN UNCERTAINTIES IN THE ECONOMICS OF NUCLEAR ENERGY FOR THE PRODUCTION OF DEALINATED WATER,
Commissariat a l'Energie Atomique (France).
L. Thiriet, and P. Lievre.
Preprint of Paper SM-113/20 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 14 p, 2 fig, 3 ref.
Identifiers: *Dual-purpose plant economics, *Energy costs, *Nuclear energy sources, Cost allocation, Economic evaluations, Energy sources, Heat transfer coefficient, Interest, Nuclear desalination.

Scaled economies favor nuclear energy over conventional thermal energy. Thus when requirements for electrical power and heat, especially for desalination, are great enough, a favorable view may be taken of the use of nuclear energy, subject to certain assumptions. The validity of conclusions reached on the basis of these assumptions is discussed. The first part of the paper examines unknown factors associated with technical, economic and financial data (various transfer coefficients, service life of parts based on choice of materials, price trends, the shape of cost functions and interest rates). The second part discusses unknown factors associated with the optimization method used and the criterion of choice selected. It is shown that in most cases it is extremely difficult to reach a categorical conclusion as to whether or not nuclear energy is competitive for desalination, as many aspects of any given situation must be considered. (In French)
W70-01960

PROGRESS IN NUCLEAR POWER AND DESALINATION,
Southern California Edison Co., Los Angeles.
W. R. Gould.
In Nuclear Energy and Latin American Development, Nuclear Energy Laboratory, Univ of Calif, Los Angeles, p 49-55, 1969. Ed by C B Smith.
Identifiers: *Nuclear energy sources, Dual-purpose plant economics, Energy sources, Fossil fuels, Reviews.

A brief review of the present status of the construction of nuclear electric power plants in the United States and of the potential for dual-purpose power-desalting plants. The general conclusion is that the growth of nuclear power will be accelerated in proportion to the extent that the coal industry is unable to hold the line on prices, and more importantly, will depend on the ultimate development of fast breeder reactors. As the results of advancing technology and continued competition from the coal industry, we have long-range prospects of cheaper electrical energy and eventually of obtaining inexpensive fresh water using nuclear power.
W70-01961

THE ROVI REACTOR FOR DESALINATION OF SEA WATER - DESIGN AND INSTALLATION CRITERIA,
Montecatini Edison, Milan (Italy).
U. Cassinari, A. Grandellini, A. Vaudo, and G. Vacchelli.
Preprint of Paper SM-113/1 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 16 p, 4 fig, 3 ref.
Identifiers: *Coupling (Reactor-Desalting Plant), *Design criteria, Converter reactors, Plant safety analysis, Reactor design, Single-purpose plant, 0-3000 MW (T) Reactors, 0-50 MGD Plant.

Basic criteria are presented for design of a single-purpose low-power reactor for desalination of seawater, as well as criteria for optimum coupling of the reactor to the desalting plant. The ROVI reactor, cooled and moderated by hydrogenated terphenyl and designed for a power level of 100 MW (T) and a fresh water output of 13 MGD, was used for the study. Safety systems, fuel handling, ancillary cooling equipment, and possibility of producing on-the-spot power required by auxiliary plant facilities are discussed in detail, with particular attention to an analysis of reliability characteristics of the plant, the problem of reserve, and measures which might be necessary in this connection. A preliminary cost estimate is made with special reference to the size of the different facilities.
W70-01962

THE ECONOMIC DEVELOPMENT OF NUCLEAR DESALTING PLANTS IN WATER AND POWER SUPPLY SYSTEMS,
Hawaii Univ., Honolulu; and Calif. Univ., Los Angeles.
N. A. El-Ramly, and J. M. English.
Preprint of Paper SM-113/35 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 10 p, 5 ref.
Identifiers: *Dual-purpose plant economics, *Economic evaluations, Cost allocation, Design, Dual-purpose plant, Fixed charge rate, Interest, Product ratio, Systems engineering.

In addition to engineering factors influencing design characteristics of dual purpose plants, optimum size, product ratio, and other pertinent design variables are also dependent on economic and social influences, often peculiar to the geographic location under consideration. Factors and constraints affecting economics of system design are discussed. Relevant design variables are incorporated into a mathematical framework to show system interrelationship. It is indicated that optimum development depends on project timing in relation to long-range demand functions of water and power. Furthermore, the decision is sensitive to interest rates, demand growth patterns, and economics of scale. Optimum product ratio is determined by maximizing present worth of revenue minus cost streams. Effects of budget and other economic constraints as they pertain to the sequence of the total system development are considered. Merits of cost allocation policies and their effect on investment decisions are discussed. It is concluded that the proper method for allocating joint costs over the system economic life should be proportional to revenue steams. Also considered is economic implication of technological changes on rate of equipment obsolescence.
W70-01963

HEAT SUPPLY TO A DESALTING UNIT BY AN ORGANIC NUCLEAR SINGLE-PURPOSE REACTOR (IN ITALIAN),
Comitato Nazionale per l'Energia Nucleare, Rome (Italy); and Montecatini Edison, Milan (Italy).
L. Biondi, E. Crispino, R. Di Menza, F. Gazzabin, and E. Merli.
Preprint of Paper SM-113/5 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 7 p.
Identifiers: *Converter reactors, *Nuclear energy sources, *Single-purpose plant economics, Dual-purpose plant, Economic evaluations, Energy sources, Single-purpose plant.

Studies were performed for both single-purpose and dual-purpose plants on the problems of supplying heat from a nuclear plant to a desalting unit as a function of the fresh water capacity. In many areas where fresh water requirements are not high, it was concluded that single-purpose reactors producing only low-temperature heat may be more satisfactory than the large nuclear reactors of the present economic sizes. Of the different reactor types, organic reactors seem to obtain more advantage from the lowering of temperature and less disadvantage from the necessary reduction of size. The main rules which must be imposed on this reactor and the expected corresponding performance are taken into consideration.
W70-01964

OPTIMIZATION STUDY ON THE COUPLING OF A LOW TEMPERATURE ROVI REACTOR WITH A DESALTING PLANT,
Bari Univ. (Italy); and Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
G. Nebbia, R. Di Menza, and L. Pierazzi.
Preprint of Paper SM-113/4 Presented at IAEA Sump Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 7 p, 1 fig, 8 ref.
Identifiers: *Single-purpose plant, *Single-purpose plant economics, *Water costs estimate, Distillatica processes, Energy costs, Multistage flash distillation, Precipitation, Scale prevention, Vapor compression evaporation.

Results of an optimization study of effects, on both reactor and distillation plant, of raising present operating temperatures to those which may be used in the future indicate that minimum steam cost in water-only low-temperature nuclear reactors such as the organic-cooled and moderated ROVI could be obtained in the range of 150 to 200 deg C. Raising maximum brine temperature from 120 to 180 deg C should decrease water costs about 15%. For high-temperature operation, probably lower water costs are obtained using distillation processes such as the LTV and vapor compression instead of multistage flash, utilizing scale control measures such as addition of saturated solution of barium chloride to seawater for precipitation of sulphates. Conclusion is that optimum conditions for desalination in developing countries may be derived using nuclear water-only plants, rather than dual-purpose plants.
W70-01965

THE FUTURE ROLE OF BREEDER REACTORS IN UTILITY PLANNING,
Westinghouse Electric Corp., Pittsburgh, Pa.
J. K. Dillard, C. J. Baldwin, and N. H. Woodley.
IEEE SPECTRUM 7 (3), p 100-107, 1969. 10 fig, 12 ref.
Identifiers: *Economic evaluations, *Electrical system designs, *Systems engineering, Boiling-water reactors, Breeder reactors, Fossil fuels, Present worth, Pressurized-water reactors, Single-purpose plant.

Economics of breeder reactors in a power system of 14,000 MW (E) initial installed capacity was studied over a 20-year period starting in 1986. Four expansion patterns with different mixes of water reactors, breeder reactors, and fossil units were compared by present worth methods using digital computer simulation programs developed to study long-range economic problems of utilities. Levelized annual savings of 25 to 50 million dollars were estimated for expansion patterns which included high gain breeders. Sensitivity studies showed that the capital cost of breeders can be over 50% higher than water reactors and still be economic, that substantial savings still exist for growth rates as low as 5%, and that the value of plutonium as fuel in breeders compared with water reactors can vary over a wide range without destroying the advantage of breeders.
W70-01966

COMPARATIVE ECONOMICS OF LARGE FOSSIL-FUELED VERSUS NUCLEAR GENERATING STATIONS,
Niagara Mohawk Power Corp., Syracuse, N.Y.
M. H. Pratt.
Proc Amer Power Conf 27, p 610-15, 1965. 2 ref.
Identifiers: *Energy sources, *Fossil fuels, *Nuclear energy sources, Economic evaluations, Energy costs, Scheduling.

We have reached the point where we can confidently expect the new generation of larger nuclear plants currently under way to be, at the very least, very close to the comparative economic level of fossil-fueled plants. The most important and critical question at the moment is whether or not we can depend on the large nuclear plant to be ready to operate as an integral part of a total system at the time when system load requirements demand that its capacity be available. The actual final costs of any project taking several years to build will always be something different from the original estimates. Since now the estimated costs for nuclear and for fossil-fired plants now have considerable overlap, the decision for one or the other must be made on the basis of the ability of meeting a schedule required by load demands.
W70-01967

BRINE-HEATER LEAKAGE CONTROL PROBLEMS IN LARGE POWER DESALTING PLANTS,
W. H. Kelley.
Reactor Fuel-process Technol 12 (1), p 80-87, 1969. 4 fig, 5 tab, 7 ref.
Identifiers: *Brine heater leakage, *Brine heaters, *Hazards, *Nuclear stream supply system, Boiling-water reactors, Breeder reactors, Brine flow, Brine system designs, Converter reactors, Dual-purpose plant, Heavy-water/organic-cooled reactors, High temperature gas-cooled reactors, Israel, Liquid-metal fast-breeder reactors, Metropolitan water district, Multistage flash distillation, Radioactive contamination, Saline contamination, Vertical tube evaporators.

A study was made of brine-heater leakage problems in large nuclear dual-purpose power-desalting plants utilizing light-water reactors and multistage flash evaporators. Leakage of reactor condensate into the water plant was found to have an inconsequential effect on product-water purity. Leakage of brine into the reactor presents a considerable problem in demineralization or blow-down-and-makeup cost. The best presently available solution to the demineralization problem appears to be the use of a coated-filter ion-exchange unit, with immediate shutdown of a leaking brine heater. An installed spare brine heater was found to be economically attractive in preventing loss of power and product-water revenues. The use of vertical tube evaporators in place of or in conjunction with the conventional brine heaters would ensure against leakage of brine into the reactor plant. Several schemes utilizing vertical tube evaporators appear economically attractive.
W70-01968

THE ROLE OF NUCLEAR ENERGY IN DESALTING - A REVIEW OF THE U.S. ATOMIC ENERGY COMMISSION DESALTING DEVELOPMENT PROGRAM, PROBLEM AREAS, AND POTENTIAL,
Atomic Energy Commission, Washington, D.C.
W. A. Williams, J. C. Roberts, and R. D. McFarren.
Preprint of Paper SM-113/36 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 14 p, 23 ref.
Identifiers: *Dual-purpose plant, Coupling (Reactor-desalting plant), Dual-purpose plant economics, Economic evaluations, Nuclear desalination, Nuclear energy sources, Reviews, Water utilization.

The Atomic Energy Commission sponsors studies and research and development aimed at utilization of nuclear energy for desalting and other large-scale industrial processes. The origin and history of the AEC program, as well as its objectives and plans, and the considerations entering into the formulation and implementation of these plans. The economics and technical features of nuclear energy in the production of desalted water and other industrial processes are discussed as well as the technical, economic, administrative and other considerations encountered and the influences these considerations have on planning the development and demonstration of a new technology and its utilization. The roles of general and specific studies are outlined and their contribution to the definition of development plans and program goals are briefly explained.
W70-01969

3B. Water Yield Improvement

RUNOFF INDUCEMENT IN AN ARID REGION BY REMOVAL OF VEGETATION,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
N. H. Tadmor, and L. Shanan.
Soil Sci Soc Amer Proc, Vol 33, No 5, p 790-794, Sept-Oct 1969. 5 p, 3 fig, 2 tab, 19 ref.

Descriptors: *Watershed management, *Arid lands, *Vegetation effects, *Clear-cutting, *Water conservation, Water yield improvement, Runoff, Infiltration, Rainfall intensity, Soil moisture, Soil water movement, Soil physical properties, Rainfall-runoff relationships, Land management.
Identifiers: Negev Desert, Israel.

Watershed management was studied in an area 25 kilometers NW of Beersheba in the Negev Desert of Israel. The climate is Mediterranean, with hot dry summers and moderately cold winters. The annual runoff increased threefold from 7% to 21% after eradication of natural vegetation. Infiltration rates were increased by 40-50% by the vegetation cover. Both bare and covered areas required 2-4 mm/day of rainfall in order to produce runoff. Interception storage was 0.1-0.4 mm. (Carstea-USGS)
W70-01658

DEVELOPMENT PROBLEMS IN ARID ZONES,
For primary bibliographic entry see Field 06B.
W70-01805

WATER RESOURCES APPRAISAL OF THE WARM SPRINGS--LEMMON VALLEY AREA, WASHOE COUNTY, NEVADA,
Nevada State Dept. of Conservation and Natural Resources, Carson City.
F. Eugene Rush, and Patrick A. Glancy.
Nevada Dept. of Conservation and Natural Resources, Water Resources-Reconnaisance Series Report 43, 1967. 70 p, 2 illus, 25 tab, 31 ref.

Descriptors: *Water resources, *Nevada, *Hydrologic aspects, *Geologic formations, *Water balance, Watersheds (Basins), Precipitation (Atmospheric), Inflow, Surface waters, Groundwater, Evapotranspiration, Irrigation, Water quality, Discharge (Water), Water supply, Hydrologic data, Transmissivity, Storage coefficient.

The area considered lies directly north of Reno in western Nevada, covering about 900 sq. mi. It is in the rain shadow of the Sierra Nevada and is arid, averaging less than 10 inches of precipitation per year. Because of its proximaty to Reno, further development of an urban-industrial nature is expected with ranching declining in importance. This report serves as a reconnaissance survey of the general hydrology of the area and may serve as a guide to further investigation as development requires. The alluvium of the valleys was found to be a maximum of at least 400 feet. To date little use has been made of groundwater-deposits, but tests for quality are suggested before beginning extensive drilling. At present all economically feasible

surface waters are developed and about 17,000 acre feet are imported annually from the Truckee River. Any additional water development will have to be from groundwater sources or importation. (Crouse-Arizona)
W70-01806

A BRIEF APPRAISAL OF THE WATER RESOURCES OF THE WALKER LAKE AREA, MINERAL, LYON, AND CHURCHILL COUNTIES, NEVADA,
Nevada State Dept. of Conservation and Natural Resources, Carson City.
D. E. Everett, and F. Eugene Rush.
Nevada Department of Conservation and Natural Resources, Water Resources-Reconnaissance Series Report 40, 1967. 44 p, 10 tab, 5 fig, 17 ref.

Descriptors: *Water resources, *Nevada, *Hydrologic aspects, *Evaporation, *Water balance, Watersheds (Basins), Lakes, Precipitation (Atmospheric), Inflow, Groundwater, Surface waters, Evapotranspiration, Geologic formations, Water quality, Irrigation, Reservoir evaporation, Discharge (Water), Hydrologic data, Groundwater recharge, Recharge, Water storage.
Identifiers: *Walker Lake (Nev).

The region considered includes Walker Lake Valley and adjacent valleys in west-central Nevada. The area is extremely arid with precipitation generally averaging less than 5 inches per year. This report gives a general reconnaissance survey of the hydrology of the area and may serve as a guide to further investigations that may prove desirable. Inflow to the area is estimated at 169,000 acre-feet per year while total discharge is about 265,000 acre-feet--largely evaporation from Walker Lake and Weber Reservoir. Walker Lake has been depleted at an average annual rate of about 100,000 acre-feet since 1908. Groundwater levels in the area have declined slowly because of lowering lake stage. The only significant groundwater development has been in the Hawthorne area for municipal and Naval Ammunition Depot use. Most of the groundwater is suitable for agricultural and municipal use. However, any future well development would have to be undertaken with the steadily declining ground water levels in view. (Crouse-Arizona)
W70-01807

PAPAGO FLOODWATER PASTURES SHOW PROMISE,
Arizona Univ., Tucson; and Bureau of Indian Affairs, Papago Indian Reservation, Ariz.
J. R. Simpson, R. A. Young, P. R. Ogden, and C. W. Whitfield.
Progressive Agriculture in Arizona, Vol 21, No 2, Mar-Apr 1969, 18-19. 2 photos, 1 tab.

Descriptors: *Range management, *Arizona, *Economic feasibility, *Costs, *Flood irrigation, Water yield improvement, Grazing, Brush control, Range grasses, Arid lands, Carrying capacity, Indian reservations, Pasture management, Irrigation practices, Runoff, Storm runoff.
Identifiers: *Papago Indian Reservation (Ariz).

Flood runoff from summer convective storms was used to irrigate supplemental perennial grass pasture on the arid Papago Indian Reservation west of Tucson, Arizona. Since the forage produced was of considerable value in providing feed during the hot, dry seasons, a cost analysis was made. It was found that where local flood runoff could be used for irrigation, the clearing and reseeding of range lands to blue panicgrass and Lehman lovegrass could be economically attractive. When amortized at 8% for 50 years, the cost was $2.14 per animal unit month. (Crouse-Arizona)
W70-01813

THE 'EL NINO' PHENOMENON AND RAINFALL IN PERU AND ECUADOR,
Texas A and M Univ., College Station. Dept. of Meteorology; and Texas A and M Research Foundation, College Station.
L. Glenn Cobb.
In Walter K. Henry et al., Research on Tropical Rainfall Patterns and Associated Mesoscale Systems. US Army Electronics Command, Ft. Monmouth, NJ Technical Report ECOM- 02313-S2, 1967, p 87-103. 17 p, 2 tab, 4 fig, 26 ref.

Descriptors: *Air circulation, *Arid lands, *Meteorology, *Ocean currents, *Precipitation (Atmospheric), Ocean circulation, California, Rainfall, Pacific Ocean, Temperature, Surface waters, Thunderstorms, Meteorological data.
Identifiers: *'El Nino' Phenomenon, *Peru, *Ecuador, Chile, Australia, Southwest Africa.

The cold Peru or Humboldt Current along the west coast of South America causes colder surface water temperatures along the coast than along the open ocean. The deserts of Chile and Peru are a result. At intervals of several years a general weakening of atmospheric circulation in the South Pacific results in a weakening of upwelling and significantly higher surface water temperatures known as the 'El Nino' phenomenon. The study reported here shows a high correlation between increased surface water temperatures and greatly increased summer rainfall on the adjacent coastal plain. Areas that normally have little or no rainfall will have at least several large thunderstorms during a season with the 'El Nino' phenomenon. It is suggested that with improved knowledge of atmospheric circulation it should be possible to predict these occurrences. Similar phenomena occur off California, southwest Africa, and western Australia. (Crouse-Arizona)
W70-01816

A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
Hebrew Univ., Jerusalem (Israel). Dept. of Agriculture; and National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
D. Hillel, and E. Rawitz.
9th International Congress of Soil Science, Adelaide, Australia, 1968, Transactions, Vol 1, p 303-311. 9 p, 4 tab, 2 fig, 3 ref.

Descriptors: *Arid lands, *Water harvesting, *Surface runoff, *Soil treatment, *Agriculture, Soil dispersants, Soil aggregates, Soil compaction, Soil erosion, Soil structure, Semiarid climates, Runoff, Soil stabilization, Erosion, Infiltration, Rainfall-runoff relationships.
Identifiers: *Israel, *Negev Plains.

In arid or semiarid lands where rainfall is insufficient but soil is otherwise arable, increase of surface runoff from sloping lands to the planted area would be of great importance. Field trials conducted in the Negev Plains included such treatments as compaction, salting, fuel oil spray, cultivation, and aggregation with krilium. Stable aggregate formation reduced runoff to practically zero, whereas crust formation with fuel oil induced runoff in excess of 80% of seasonal rainfall. Excessive erosion occurred in salt-treated and cultivated plots. Erosion from the fuel oil treatment was low. This promising treatment would also be useful for water harvesting applications. (Crouse-Arizona)
W70-01820

THE ISRAELI ARTIFICIAL RAINFALL STIMULATION EXPERIMENT. STATISTICAL EVALUATION FOR THE PERIOD 1961-65,
Hebrew Univ., Jerusalem (Israel).
K. R. Gabriel.
Berkeley Symposium on Mathematical Statistics and Probability. 5th, Berkeley California, 1965-1966, Proceedings, Vol 5, 1967, p 91-113. 23 p, 12 tab, 3 fig, 28 ref.

Descriptors: *Cloud seeding, *Statistical methods, *Silver iodide, *Arid lands, Weather modification, Design criteria, Aircraft, Data collections, Precipitation (Atmospheric), Analytical techniques.
Identifiers: *Israel, *Experimental design, Randomized crossover design.

This paper presents a statistical evaluation of effects on precipitation of cloud seeding experiments using silver iodide in Israel. A randomized crossover design was used. Problems of analysis and advantages of design are discussed. Average excess of precipitation on seeded days was about 15% - significant at the 5% level. The secondary objective of identifying meteorological conditions favorable or unfavorable to successful stimulation was not achieved at the time of this report. Apparently, effects of seeding did not persist beyond the day of seeding. (Crouse-Arizona)
W70-01821

THE NILE IN THE SUDAN,
Khartoum Univ. (Sudan).
L. Berry, and A. J. Whiteman.
Geographical Journal Vol 134, PT 1, 1968, p 1-37. 6 tab, 19 fig, 52 ref.

Descriptors: *Geomorphology, *Geographical regions, *River systems, *Arid climates, *Stratigraphy, Geologic investigations, Evaporation, Geologic formations, Hydrogeology, Geologic mapping.
Identifiers: *Physical geography, *Geography, *Nile, Sudan, Egypt, Ethiopia, Africa.

Many scientists have studied the Nile--a main source of water for the agriculture of arid Sudan and Egypt. However, its physical history is little known, since most of the work has been concentrated on Egyption stratigraphy and denudation chronology. In this study the authors recognize four major sections, each of which is considered separately: the Blue Nile Basin, the Victoria and Albert Nile, the White Nile or Bahr el Abiad Basin, and the Main Nile Basin. The authors have conducted extensive field work and their findings, together with a critical review of pertinent literature, lead to the conclusion that sections of the Nile had their origins in Late Cretaceous times or earlier. The present Nile, then, is a complex formed by chance linkage of several basins with different structural and erosional histories. It is hypothesized that in drier times such as occurred in the head waters of the Blue Nile during periods of the Pleistocene, the waters would not have reached the White Nile or the Main Nile, but would instead have spread out and been lost in the arid Sudan. Tentative denudation and depositional chronologies are presented. (Crouse-Arizona)
W70-01828

WATER USE AND MANAGEMENT OF PONDEROSA PINE IN NORTHERN ARIZONA,
Arizona Univ., Tucson. Dept. of Watershed Management.
W. L. Russel and J. L. Thames.
Progressive Agriculture in Arizona, Vol 20, No 5, Sep-Oct 1968, p 10-11. 2 fig.

Descriptors: *Watershed management, *Arid lands, *Soil-water-plant relationships, *Water yield improvement, *Forest management, Arizona, Clear-cutting, Evapotranspiration, Water loss, Soil moisture, Pine trees, Ponderosa pine trees, Moisture content.

Principle sources of water for arid-land agricultural and urban valleys of Arizona are the high elevation ponderosa pine forests. Sound management of these watersheds requires knowledge of the water use and the potential for improving water yield of this species. Three study sites were used: a natural second growth pine plot with about 150 square feet basal area, one plot thinned to 40% of the original volume of pine growth, and a third clearcut with remaining vegetation killed chemically. There was

an approx. 80% difference in water loss between natural and clear-cut sites. The difference between natural and thinned plots was only about 20% of the difference shown on the clear cut. Water savings on the thinned area were not proportionate to the volume of timber removed. Results indicate that clear-cutting practices similar to West Coast block cuts would be advantageous from the standpoint of water yield. (Crouse-Arizona)
W70-01829

REPORT ON EVAPORATION CONTROL ON STOCK TANKS, RESERVOIRS,
Arizona Univ., Tucson. Water Resources Center.
C. Brent Cluff.
Progressive Agriculture in Arizona, Vol 19, No 2, p 4-5, Mar-Apr 1967. 4 fig.

Descriptors: *Evaporation control, *Monomolecular films, *Reservoir evaporation, Arizona, Water costs, Costs, Application equipment, Seepage.
Identifiers: *Evaporation control devices, *Rafts, Dispensers.

Methods for applying monolayer alcohols to reduce evaporation losses from stock ponds and small reservoirs in Arizona were tested. The most efficient was a wind operated dispenser. Even with this machine, costs per thousand gallons saved were over $3.50 for tanks up to one acre in size. The cost did not drop below $1.00 per thousand gallons unless the reservoir surface exceeded 15 acres. Several types of floating plastic rafts were found to be very effective in controlling evaporation losses. The most efficient had costs per unit lower than most domestic water supplies. (Crouse-Arizona)
W70-01834

RESULT OF CLOUD SEEDING EXPERIMENT AT DELHI AS ASSESSED BY RADAR,
Inst. of Tropical Meteorology, Poona (India).
R. N. Chaterjee, K. R. Biswas, and Bh. V. Ramana Murty.
Indian J Meteorol and Geophys, Vol 20, No 1, p 11-16, Jan 1969. 6 p, 6 tab, 6 ref.

Descriptors: *Cloud seeding, *Radar, Microwaves, Rain, Monsoons, Precipitation (Atmospheric), Seasonal, Instrumentation, Analytical techniques, Rain gages.
Identifiers: *India.

The result of cloud-seeding experiments conducted in the Delhi, India, area from 1961 to 1966 were examined by using a high-power microwave radar measuring areal echo coverage and echo height of rain cells. The trend of the result is positive on the basis of areal echo coverage, and negative on the basis of mean echo heights. However, as the assessment made is only qualitative in nature, it does not confirm that the rain over the area is increased by seeding by the specific amount indicated by the analysis. (Gabriel-USGS)
W70-01876

WEATHER MODIFICATION: LAW AND ADMINISTRATION,
Colorado Univ., Boulder.
James N. Corbridge, Jr., and Raphael J. Moses.
Natural Resources Journal, Vol 8, No 2, p 207-235, Apr 1968. abt 150 ref.

Descriptors: *Weather modification, *Legal aspects, *Administration, Legislation, History, Administrative agencies, United Nations.
Identifiers: Supra-national administrative system, Powers and responsibilities.

The article evaluates the present scientific and legal situation of weather control. Section I summarizes the historical development of weather modification. Sections II, III and IV discuss the development of private law doctrines and existing and proposed legislation. Existing law has evolved around property rights and remedies for the invasion of these rights. Section V demonstrates the need for a different legal approach. The first need is for establishment of a central administrative agency to supervise all weather modification activity in each country. This agency should register and license operators, impose controls on operation, require assurance of financial responsibility in the event of damage, and collect and disseminate information. Section VI analyzes possible legal and administrative solutions. Models include the Atomic Energy Act, the U.N. Committee on Peaceful Uses of Outer Space, the European Space Research Organization (ESRO/CERS) and the European Organization for the Development and Construction of Space Vehicle Launcers (ELDO/CECLES). The United Stations is proposed as a locus for an international, supra-national system of licensing, inspection and reporting. (Gossen-Chicago)
W70-02028

3C. Use of Water of Impaired Quality

PRELIMINARY STUDY OF A DESALTING POWER INDUSTRIAL COMPLEX IN ISRAEL,
Israel Atomic Energy Commission, Tel Aviv; and Water Planning for Israel Ltd., Tel Aviv.
J. Adar, D. Caplin, G. Frank, and D. Tavory.
Preprint of Paper SM-113/10 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 30 p, 4 fig, 4 ref.
Identifiers: *By-product economics, *By-product manufacturing processes, *Electrochemonuclear systems, *Israel, Dual-purpose plant, Economic evaluations, Energy costs, Feasibility study, Industries, Nuclear energy sources, 3000 plus MW (T) reactors, 51-250 MGD plant.

A dual-purpose plant will be needed in Israel in the middle 1970s to add some 300 MW (E) and 150 mgd to the national electricity and water grids. This study examines the profitability of combining with the dual-purpose plant an industrial complex fed by the low-cost incremental power (either electricity or low-pressure steam) of the larger reactor that would be required. The study includes two parts. (1) Incremental costs of power are estimated. Use of us light-water reactors of 2370 and 3300 mwt (or combination of both) is considered. Depending on size and number of reactors and on different steam cycles chosen, amounts of incremental electricity and low-pressure steam available for industrial complex vary between 118 to 930 mwe and 0 to 3.95 million lb/hr. Depending also on the different fixed charge rates considered, costs vary between 1.82-5.5 mill/kwh and 0-76 cents/mbtu. (2) A preliminary survey of process industries (chemical and metallurgical) is made. Processes were selected according to market possibilities for products or derivatives, preference for utilization of local raw material and/or intermediaries, the advantage of processing in Israel certain minerals or mineral concentrates. Effects of basic industries considered on the overall economic development of Israel is reviewed.
W70-01732

DUAL-PURPOSE NUCLEAR POWER PLANT WITH INCORPORATED PRODUCTION OF SALT,
Tokyo Inst. of Tech., (Japan); and Asahi Chemical Industry Co. Ltd., Tokoyo (Japan).
H. Kakihana, and Y. Tsunoda.
Preprint of paper SM-113/11 presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 12 p, 10 fig.
Identifiers: *By-product economics, *By-product manufacturing processes, Chemical by-product, *Dual-purpose plant economics, Electrochemonuclear systems, Japan, Membrane processes, Multipurpose plant, Multipurpose plant economics, Scale prevention.

Since Japan imports all its industrial salt, it is desirable to salvage brine from evaporation, concentrating it by electrodialysis and evaporating it. One overall plan for such utilization of seawater is discussed. This process is characterized by the use of a special type of anion and cation exchange membranes in the electrodialysis, incorporating it into the evaporation step of a dual-purpose nuclear power plant. Scaling in the heat exchanger of the evaporator is greatly reduced, making the distillation operation easier and less expensive. In addition to production of electric power, fresh water and industrial salt, if the plant is large enough five other products may be manufactured - magnesium hydroxide, chlorine, glaubers salt, potassium chloride, gypsum, and hydrogen.
W70-01733

ECONOMIC CONSIDERATIONS OF NUCLEAR ENERGY CENTRES FOR THE PRODUCTION OF CHEMICALS FROM SEA SALT IN DEVELOPING COUNTRIES,
United Nations Industrial Development Organization, Vienna (Austria).
P. M. Terlizzi.
Preprint of Paper SM-113/13 presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 20 p, 5 fig, 2 ref.
Identifiers: *Agro-industrial complexes, *Chemical production, *Nuclear energy sources, By-product economics, By-product manufacturing processes, Economic evaluations, Electrochemonuclear systems, Energy sources, Feasibility study.

The economics of production of chemicals from sea salt in developing countries utilizing nuclear fuel system is reviewed. The use of selected nuclear systems versus solar evaporation techniques, freezing, and geothermal resources as well as the level of nuclear fuel system sophistication which could possible be utilized to economic advantage are discussed in terms of technology, investment, personnel requirements and marketing economics of chemicals produced.
W70-01734

APPLICATION OF THE HTGR-CCGT SYSTEM IN DUAL-PURPOSE NUCLEAR POWER PLANTS,
Hoterv, Budapest (Hungary).
J. Halzl, Z. Szabo, L. Szucs, and M. Torma.
Preprint of Paper SM-113/14 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 26 p, 15 fig, 4 ref.
Identifiers: *Gas turbines, *High-temperature gas-cooled reactors, Aluminum, Dual-purpose plant, Electrochemonuclear systems, Energy sources, Flowsheets, Heat balance, Heat exchangers, Heat recovery, Heat transfer, Nuclear energy sources, Thermodynamics, Turbines.

The use of the high-temperature gas-cooled reactor closed-cycle gas-turbine (HTGR-CCGT) for the simultaneous supply of heat and electricity and its application to alumina-aluminum producing industrial complexes and to water desalination is explored. The influence of heat exchanger costs on the overall economy of the CCGT system is emphasized. In order to reduce costs it is suggested that mercury in specially designed equipment be used as heat-transmittent medium. Solutions of several heat exchanger design problems are presented, with several diagrams for the dimensioning of high-efficiency plate fins, taking into account both the temperature variation of the temperature field, existing in the gas flow, and the heat conduction of the fin, also in the direction of the flow.
W70-01735

APPLICATION OF NUCLEAR REACTORS IN THE ALUMINA AND ALUMINUM INDUSTRY,
Hoterv, Budapest (Hungary).
J. Halzl, G. Sigmond, Z. Szabo, and M. Torma.
Preprint of Paper SM-113/15 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 15 p, 5 fig, 2 ref.
Identifiers: *Aluminum, *Economic evaluations, *Multipurpose plant, *Multipurpose plant economics, Chemical production, Elec-

trochemonuclear systems, Energy sources, Nuclear energy sources.

The potentialities of dual-purpose nuclear power plants in the alumina-aluminum industry are analyzed. Results are summarized of economy calculations both for the back-pressure power plant supplying heat and electricity for an alumina plant only and for the power plant supplying both the alumina plant and the aluminum shelter. The calculations were done in terms of the capacity of the alumina plant using the following parameters - (A) rate of amortization, (B) power credit, (C) cost of fossil fuel, and (D) temperature level of heat demand. Nuclear energy supply variants were based on the PWR reactor but for big alumina plants and for the combined supply of the alumina plant and the aluminum smelter, the application of AGR reactors was also investigated.
W70-01736

POSITIONS OF COMPETITION BETWEEN WATER OBTAINED BY DESALINATION AND NATURAL RESOURCES,
Commissariat a L'Energie Atomique, France.
J. Gaussens.
Preprint of Paper SM-113/19 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 12 p, 5 fig.
Identifiers: *Economic conditions, *Water utilization, Base-load, Economic evaluations, Peaking power, Water sources.

The planning of a seawater desalting plant in a given region involves careful consideration of local fresh water supply and demand. In many cases, a thorough study of the natural resources available reveals that desalination is not needed. In other cases natural resources and desalination systems can be complementary, with the one contributing to the peak demand and the other to the base load. This analysis makes it possible to classify the main consumer regions according to certain economic criteria which define their suitability for the use of desalination processes. (In French)
W70-01737

CONTRIBUTION TO THE ECONOMIC STUDY OF MULTIPLE-PURPOSE PLANTS FOR POWER GENERATION, SEA WATER DESALINATION AND INDUSTRIAL CHEMICAL PRODUCTION,
Groupement d'Etudes de Dessalement Des Eaux Salees, Paris (France).
R. Douvry, and P. E. Dorges.
Preprint of Paper 113/22 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 31 p.
Identifiers: *Electrochemonuclear systems, *Multipurpose plant, Chemical by-products, Chemical production, Dual-purpose plant, Dual-purpose plant economics, Economic evaluations, Fertilizer, Multipurpose plant economics.

Optimization of dual-purpose plants results in production of considerably more electricity than can be used in many countries which can utilize the fresh water production. Therefore, association of these units with large power-consuming industries becomes potentially profitable, and it is possible to plan multiple purpose plants producing electricity, fresh water, industrial chemicals, fertilizers and electro-metallurgical goods. In industrialized countries output from these plants can be marketed in the area produced, but in other countries the output must be sold for export, either as semi-finished products or as processed raw material. This study considers the various products which can be processed in triple-purpose plants, both in the general case and at particular geographical locations. (In French)
W70-01738

ENERGY-INTENSIVE AND HEAT-INTENSIVE PROCESSES FOR A NUCLEAR ENERGY CENTER,
Oak Ridge National Lab., Tenn.
J. M. Holmes.
In abundant Nuclear Energy, Proc Symp Gatlinburg, Tenn, Aug 1968. p 29-43, 1 fig, 6 tab, 24 ref. AEC Symp Ser 14 (CONF-680810) 1969.
Identifiers: *Agro-industrial complexes, *By-product manufacturing processes, *Nuclear energy sources, *Process heat, By-product economics, Chemical by-products, Chemical production, Electrochemonuclear systems, Energy costs, Energy sources, Fertilizer, Multipurpose plant.

Chemical and metallurgical industries are large energy consumers with increasing power demands and significant sensitivities to changes in electricity prices. The major categories considered for installation at nuclear energy centers include (1) balanced fertilizers, (2) metals, such as aluminum, iron, steel, and magnesium, (3) plastics, and (4) brine chemicals. Other energy-intensive systems that may show promise include waste-water treatment, electric railways, high-temperature process heating, urban space heating, and several recently developed electroorganic processes. For economic utilization of the power from a 1000 MW (E) nuclear reactor, a number of the proposed systems would have to be combined into a complex.
W70-01739

A BLEACHED STRAW PULP MILL FOR AN AGRO-INDUSTRIAL COMPLEX,
Parsons and Whittemore, Inc., New York.
J. N. McGovern.
IN Abundant Nuclear Energy, Proc Symp Gatlinburg, Tenn, Aug 1968. p 205-18, 2 fig, 6 tab, 8 ref. AEC Symp Ser 14 (CONF-680810) 1969.
Identifiers: *Agro-industrial complexes, *By-product manufacturing processes, *Nuclear energy sources, *Process heat, By-product economics, Energy costs, Energy sources, Multipurpose plant.

The size and type of a hypothetical pulp mill to be part of an agro-industrial complex and to use residual wheat straw are developed. The choice of a pulping process is discussed, and process and material flows for the resultant 500 ton/day bleached sulfate pulp mill are shown. The mill would use power, heat, and water from the complex. The properties of short-fiber straw are compared with those of wood fibers, and a promising market for the straw pulp in the manufacture of book paper in developing countries is indicated. Plant-site factors are mentioned briefly. Capital requirements for the hypothetical mill are estimated at $60 to $65 million. It is considered that the hypothetical mill could be practical.
W70-01740

MARINE CHEMICAL RECOVERY,
Oak Ridge National Lab., Tenn.
W. C. Yee.
IN Abundant Nuclear Energy, Proc Symp Gatlinburg, Tenn, Aug 1968. p 249-68, 10 fig, 12 ref. AEC Symp Ser 14 (CONF-680810) 1969.
Identifiers: *Agro-industrial complexes, *By-product manufacturing processes, *Nuclear energy sources, *Process heat, *Solar energy sources, Chemical by-products, Chemical production, Multipurpose plant.

An economic analysis is made of several possible salt complexes that recover chemicals from the brine discharge of a nuclear desalination plant producing 100 MGD of fresh water with a seawater concentration factor of 2. Primary product recovery involves using solar energy at an arid desert site to recover sequentially gypsum, salt, potash, and magnesium chloride by fractional crystallization. Secondary product production involves using electrical and steam energy from the desalination plant to obtain cement and sulfuric acid, caustic soda and chlorine, and magnesium metal. Caustic soda and chlorine (as hydrochloric acid) can be used to remove bicarbonate ions from seawater prior to fresh-water production. Land requirements for solar evaporation are reduced by the availability of evaporator effluent as a starting material. The utilization of 3% of the brine discharge (2 x seawater) would consume 400 MW (E) of electric power, would require a capital investment of $84 million, would generate an income of $40 million, and would have a break-even power cost of 5.5 mills/kwhr at a 10% cost of money. Seawater treatment by the caustic-hydrochloric acid method would compete with the conventional sulfuric acid method of treatment at a power cost of 4 mills/kwhr when sulfur costs $50/ton.
W70-01742

THE CHEMICAL UTILIZATION OF WATER-DESALINATION RESIDUES,
United Nations Industrial Development Organization, Vienna (Austria).
N. K. Grigoriev.
In Proc Panel, Value to Agriculture of High-quality Water from Nuclear Desalination, Vienna 1967, p 65-74. 3 tab, 8 ref. (IAEA STI/PUB/210, 1969). Was Paper PL-264/2 at meeting.
Identifiers: *By-product economics, *Chemical by-products, By-product manufacturing processes, Chemical production, Economic evaluations.

Seawater contains many salts, and this paper mentions several publications describing the industrial potentialities. A model plant is then described for recovering chemicals from water-desalination residues. The suggestion is that seawater be chlorinated, filtered and frozen. The residue after separation of ice is treated with gypsum and cooled to a lower temperature to yield sodium chloride, potash and bromine. Subsidiary processing would yield caustic soda, chlorine, hydrogen, lime, magnesia, hydrochloric acid and other products. Costs are quoted and the value of the fresh water is estimated at 10 cents/1000 gal.
W70-01743

THE DESIGN OF WATER SUPPLY SYSTEMS BASED ON DESALINATION.
United Nations, New York.

ST/ECA/106, 1968. 64 p, 6 tab, 8 fig, 3 ref.
Identifiers: *Economic evaluations, *Feasibility study, *Water utilization, Capitalized costs, Distillation processes, Fixed charge rate, Interest, Investment (Fixed), Operating costs, Plant availability, Water costs estimate, Water sources, Water storage.

Since the design of a water supply involving desalination is strongly influenced by local conditions, it is recommended that cases be analyzed individually. The major system variables include the number of units and the total capacity of desalination to be installed and amount and type of storage to be installed. Knowledge is needed of (1) demand characteristics - existing and expected future levels, including details of short-term and seasonal variations, (2) the types and capacities of storage which can be made available locally and the costs of these facilities, and (3) the likelihood and duration of periods of downtime to which any desalination plant configuration may be subject. Three types of situations have been considered (1) desalination as the sole source of water supply, (2) desalination in conjunction with ground-water supplies, and (3) desalination in conjunction with surface-water supplies. A narrative discussion of the above factors is given and an appendix covers sample calculations for the various items considered.
W70-01744

POWER - IS IT THE KEY TO FOOD SUFFICIENCY IN INDIA,
California Univ., Davis.
P. R. Stout.
Bull At Sci 24 (9), 1968, p 26-28.
Identifiers: *Agriculture, *Fertilizer, *Land utilization, *Water utilization, Agro-industrial complexes, Energy sources, India, Nuclear energy sources.

Food sufficiency can be achieved and maintained in India if adequate sources of low-cost energy can be established quickly. But power must be made

available to pump water out of the ground for irrigation and to manufacture nitrogen fertilizer. These energy-consuming farm inputs would enable Indian farmers on the Indo-Gangetic plan to grow high-yield cereal grains during the winter dry season, when good lands now lie idle. Nuclear energy appears to be the quickest and cheapest means of providing this electrical power. Power levels would have to approach the energy inputs required by intensive cultivation practices in the worlds food-sufficient, industrialized nations. One reactor, providing power for irrigation and for the manufacture of 352,000 tons of fixed nitrogen, makes it possible to grow an additional 12.3 million tons of food grain. Two such units would be sufficient to fill Indias estimated 1973 gap in food grain of 23 million tons. A third unit, added by 1978, a fourth in 1983, and a fifth in 1988 would be required to keep the gap closed. A sixth unit by 1990 would fill the minimum shortage, predicted for that time, of 72 million tons.
W70-01745

ECONOMIC CONSIDERATIONS IN INTRODUCING DESALTED WATER INTO AGRICULTURE,
Water Commission of Israel, Tel Aviv.
E. Dlayahu.
In Proc Panel, Value to Agriculture of High-quality Water from Nuclear Desalination, Vienna 1967, p 93-104. 9 ref. (IAEA STI/PUB/210, 1969). Was Paper PL-264/3 at meeting.
Identifiers: *Agriculture, *Economic evaluations, *Water utilization, Ground rules, Israel, Land utilization.

Technological advances of recent decades have made large-scale desalination technically possible. The remaining obstacle to such development is economic. The testing ground of economic feasibility lies in agriculture, the major and marginal consumer of water. Criteria are discussed here for determining economic feasibility of using desalted water in agriculture, drawing on the experience of Israel for illustration. Topics dealt with include water costs, prices and subsidies, methods of estimating the value of irrigation water, economic and agro-technical problems in the large-scale use of desalted water, and quantity and quality as factors determining the value of desalted water. The following conclusions are drawn - with current techniques, a gap still exists between costs and benefits. Large plants of the future offer prospects of internal economics, but must face external diseconomics of scale. Desalination offers the best prospects, economically, in arid zones requiring perennial irrigation water. Greater economic benefits may be expected from water quality than from quantity. Best prospect for development in the near future lies in continued research and effective exchange of information, rather than in artificial stimulation by direct subsidization.
W70-01747

SOME CONSIDERATIONS OF THE VALUE TO AGRICULTURE OF HIGH-QUALITY WATER FROM NUCLEAR DESALINATION,
Food and Agriculture Organization of the United Nations, Rome (Italy).
H. G. F. Kreutzer.
In Proc Panel, Value to Agriculture of High-quality water from Nuclear Desalination, Vienna, 1967, p 77-92. 8 tab, 8 ref. (IAEA STI/PUB/210, 1969). Was Paper PL-264/14 at meeting.
Identifiers: *Agronomy, *Water costs estimate, *Water utilization, Agriculture, Land utilization.

The cost of water from nuclear desalination plants is still too high in comparison with what farmers pay at present for irrigation water from conventional sources. For the time being there seems to remain a very wide field of research work concerning the exact determination of water requirements under various conditions, the breeding and selection of salt-tolerant plants, which guarantee yields that are almost as high as those obtained under normal conditions, the improvement and application of the most advanced irrigation techniques, and the control of evaporation and seepage losses surface-water storage. There seems to exist only a few possibilities of making use of the power produced in the context of the desalination process, as agriculture itself can only undertake a very small part of it. To make the desert bloom, irrigation needs tremendous quantities of water at a low cost at the irrigation site. In view of the rapid development in this fairly new field of experimentation, it is hoped that further experiments, or even a breakthrough, may allow the food and agriculture organization to recommend its widespread application to agriculture.
W70-01748

THE ROLE OF NUCLEAR ENERGY IN DESALTING WATER FOR AGRICULTURE,
Oak Ridge National Lab., Tenn.
R. P. Hammond.
In Proc Panel, Value to Agriculture of High-quality Water from Nuclear Desalination, Vienna 1967, p 9-22. 4 tab, 4 fig. (IAEA STI/PUB/210, 1969). Was Paper PL-264/18 at meeting.
Identifiers: *Agriculture, *Economic evaluations, *Nuclear desalination, AEC sponsored, Energy sources, Heat transfer improvements, Land utilization, Nuclear energy sources, Water costs estimate, Water utilization.

The great importance of energy in the productivity of agriculture has only recently been recognized. Since the easily cultivable land in the world is fully utilized, the needs for more food will have to be met by increasing the output from present acreage and by bringing water to land which is now too dry for farming. Both methods require energy, in the form of fertilizer, cultivating power, insecticides and herbicides, pumps, and desalting of seawater. In many parts of the earth, nuclear energy is already the cheapest available form of large energy source, and the advent of the breeder reactor will lower cost still more. A look at the fuel resources available for breeder reactors shows that they are as inexhaustible as the water of the ocean. Since agriculture will need very large amounts of energy, especially for desalting seawater, the very size of the installations will help to reduce the unit cost of energy. Besides cheap energy, water production requires low-cost evaporators, and important breakthroughs have been made in the technology of evaporator design. One of these is the use of double-fluted vertical tubes, which transfer heat more cheaply than conventional tubes. Other improvements are concerned with the use of concrete construction and scale control.
W70-01749

THE NUCLEAR-POWERED AGRO-INDUSTRIAL COMPLEX,
Oak Ridge National Lab., Tenn.
R. P. Hammond.
In Proc Panel, Value to Agriculture of High-quality Water from Nuclear Desalination, Vienna 1967, p 31-64. 15 tab, 10 fig. (IAEA STI/PUB/210, 1969). Was Paper PL-264/19 at meeting.
Identifiers: *Agro-industrial complexes, *Economic evaluations, AEC sponsored, Agriculture, Capitalized costs, Chemical production, Fertilizer, Land utilization, Nuclear energy sources, Water costs estimate, Water utilization.

A study team of expert consultants and scientists of the Oak Ridge National Laboratory is attempting to determine, technically and economically, what can be accomplished by using low-cost nuclear energy under optimum conditions for desalting seawater and for providing industrial power. An agro-industrial complex centered on two large reactors can produce water to grow food for several million people and can supply power to industries producing fertilizer and other electrochemical products. Selected crops and industrial products, selling at current world prices, can produce a return on investment estimated to be in the range of 10 to 20% per year. Total capital costs are estimated between 500 to 1500 million dollars, depending on size and other variables. Information has been developed for industrial complexes without desalting and for various sizes of farming areas up to about 200,000 acres in summer and 280,000 acres in winter using the output of a 1 BGD desalination plant. A town of 30,000 to 60,000 people is required for workers, their families, and supporting services and is included in cost estimates. Results of the work are encouraging.
W70-01750

VALUE OF WATER USED FOR SUPPLEMENTAL IRRIGATION IN ENGLAND AND WALES,
Ministry of Agriculture, Fisheries and Food, London (England).
C. N. Prickett.
In Proc Panel, Value to Agriculture of High-quality Water from Nuclear Desalination, Vienna 1967, p 125-44. 9 tab, 10 ref. (IAEA STI/PUB/210, 1969). Was Paper PL-264/9 at meeting.
Identifiers: *Agriculture, *Water costs estimate, *Water utilization, Capitalized costs, Land utilization.

The paper gives data concerning the marginal costs and returns attributable to supplemental irrigation in the humid climatic conditions of England and Wales. Costs are divided into internal and external costs. Internal costs are those incurred within the farm boundary for receiving, storing, and distributing the water to the crops. External costs are water charges for abstraction from surface or groundwater sources, or charges for a piped supply from the general public system. Some theoretical estimates are also made of the external costs involved in supplying and distributing water to a number of farms in a designated irrigation area. For comparison with the costs, estimates are given of the likely effects of irrigation in terms of increased yields and increased gross margins per acre-inch of water applied. In making comparisons allowance would need to be made for the increased costs if desalted water were used. Comparisons indicate that there is little scope for use of desalted water for irrigation in England and Wales, with a possible exception of the irrigation of high-value crops in an area immediately adjoining a generating station.
W70-01751

INSTITUTO NACIONAL DE COLONIZACION, MADRID (SPAIN),
Cost of Irrigation Water in Spain.
A. Murcia, and A. M. Maqueda.
In Proc Panel, Value to Agriculture of High-quality Water from Nuclear Desalination, Vienna 1967, p 111-23 (IAEA STI/PUB/210, 1969). Was Paper PL-264/4 at meeting.
Identifiers: *Agriculture, *Spain, *Water costs estimate, *Water utilization, Capitalized costs, Land utilization.

A prerequisite to the study of agricultural applications of water from nuclear desalination plants is a knowledge of the economic value of the water. Owing to the lack of rainfall in arid countries, water may be considered as the main factor governing agricultural production and its economic value, up to the maximum, may be arrived at by crediting the entire increase in production achieved through the use of irrigation water to that factor alone. There is also another, minimum value, arrived at by adding the annual cost of the implementing the project and the cost of operating the works and facilities. The paper outlines methods for calculating such values, as well as an additional, weighted, value obtained by attributing to the water only part of the savings achieved. There follows an itemization of the prices currently paid by Spanish farmers for irrigation water in valleys where the commodity is scarce and in those where it is abundant, together with indications of the prices they might have to pay, depending on circumstances, for high-quality desalted water.
W70-01752

VALUE TO AGRICULTURE OF HIGH-QUALITY WATER FROM NUCLEAR DESALINATION.
International Atomic Energy Agency, Vienna (Austria).

IAEA STI/PUB/210, 1969, Proc Panel, Vienna 1967. 278 p, 53 fig.
Identifiers: *Agriculture, *Land utilization, *Nuclear desalination, *Water utilization, Agro-industrial complexes, Agronomy, By-product economics, Economic evaluations, Feasibility study, Fertilizer, Nuclear energy sources, Reviews, Water costs estimate, Water sources.

Report of a panel organized by the IAEA and held in Vienna, from 30 October to 3 November 1967. The meeting was attended by 30 experts from 13 countries and 3 international organizations. The contents include papers in which some economic and agricultural aspects are discussed, such as the value to agriculture of high-quality water from nuclear desalination, cost of irrigation water, water quality and yield depression, tolerance of certain crops to salinity and agronomic aspects of irrigation with brackish water. A conversion table is given in an annex. Each paper is in its original language (19 English and 3 French) and is preceded by an abstract in English with one in the orginal language if this is not English. Discussions are in English.
W70-01761

ATRIPLEX POLYCARPA: I. GERMINATION AND GROWTH AS AFFECTED BY SODIUM CHLORIDE IN WATER CULTURES,
California Univ., Riverside. Dept. of Agronomy.
For primary bibliographic entry see Field 02I.
W70-01800

BORON TOLERANCE OF TALL WHEATGRASS,
Department of Agriculture, Lincoln, Nebr.
For primary bibliographic entry see Field 03F.
W70-01825

SOME EFFECTS OF HIGH SALINITY ON GERMINATION AND EMERGENCE OF BARLEY,
Arizona Agricultural Experiment Station, Tucson.
T. J. Donovan, and A. D. Day.
Agronomy Journal, Vol 61, No 2, Mar-Apr 1969, p 236-238. 3 tab, 9 ref.

Descriptors: *Salinity, *Barley, *Plant growth, *Salt tolerance, *Germination, Arid lands, Soil-water-plant relationships, Saline soils, Seeds, Plant physiology, Arizona, Saline water.
Identifiers: Emergence (Seedlings).

Salinity frequently limits crop production in arid and semiarid agricultural regions. Thirty-nine barley varieties and lines were germinated in distilled water and in a water and sandy loam culture salinized to various concentrations. Most commercial varieties of barley had lower germination rates than did California Mariout and several saline tolerant strains developed by the USDA. Emergence in salinized soils was comparable to germination in water solutions. At moderate salinity levels most of the barleys performed well. At high salinity only the California Mariout and the salt tolerant strains were satisfactory. All the barleys were delayed in emergence in the highly saline media. In saline areas, tolerant barleys should be used, or if irrigation practices permit maintenance of low salinity during germination, higher salinity at later stages may not greatly affect yields. Laboratory methods are useful in screening barley varieties but should be supplemented by field trials. (Crouse-Arizona)
W70-01826

BENEFICIAL USES OF THERMAL DISCHARGE,
New York State Dept. of Commerce, Albany; and State Univ. of New York, Albany. Atmospheric Sciences Research Center.
For primary bibliographic entry see Field 05C.
W70-01922

INTEGRATION OF WATER REQUIREMENTS IN ARID AREAS BY MEANS OF DUAL-PURPOSE PLANTS FOR THE DESALINATION OF SEA WATER AND PRODUCTION OF ELECTRIC POWER. OPERATIONAL RESULTS OBTAINED BY THE ITALSIDER PLANTS AT TARANTO, ITALY (IN ITALIAN),
Societa Italiana Implanti, Genoa.
For primary bibliographic entry see Field 03A.
W70-01947

3E. Conservation in Industry

THE SELECTION OF NUCLEAR POWER AND DESALINATION PLANTS FOR AUGMENTING EXISTING WATER RESERVES,
Associated Nuclear Services, London (England).
H. A. Mathews, E. F. O. Masters, and F. K. Orde.
Preprint of Paper SM-113/51 Presented at IAEA Symp Nucl Desalination, Madrid, Nov 18-22, 1968. 33 p, ref, 5 fig.
Identifiers: *Water utilization, Dual-purpose plant, Energy sources, Fossil fuels, Load factor, Load following, Nuclear desalination, Nuclear energy sources, Water costs estimate, 0-50 MGD plant, 0-500 MW (E) reactors.

Whereas nuclear desalination is usually discussed and studied in the context of large capacities and high levels of utilization, implying base load requirements of high order of production, the possibility is considered here of utilizing reactors of the lower range of output to meet less favorable demands likely to occur before development of the ideal large-scale nuclear desalination plants. Ways are discussed of best employing reactors, power systems and water systems to obtain the most economic solution. It is suggested that the high availability characteristics of nuclear reactors may be exploited for this purpose. Attention is given to desirable characteristics of desalination plants and attainment of lower water costs.
W70-01718

PUMPED STORAGE - THE HANDMAIDEN OF NUCLEAR POWER,
Northeast Utilities Service Co., Hartford, Conn.
For primary bibliographic entry see Field 03A.
W70-01951

3F. Conservation in Agriculture

EFFECTS OF PETROLEUM MULCH ON SOIL WATER CONTENT AND SOIL TEMPERATURE,
Oregon State Univ., Corvallis. Dept. of Soils.
For primary bibliographic entry see Field 02G.
W70-01651

PROFILE MODIFICATIONS OF A SLOWLY PERMEABLE SOIL,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
For primary bibliographic entry see Field 02G.
W70-01656

THE ESTIMATION AND OCCURRENCE OF AGRICULTURAL DROUGHT,
Department of Agriculture, Ashburton (New Zealand). Winchmore Irrigation Research Station.
D. S. Rickard, and P. D. Fitzgerald.
J Hydrol (New Zeal), Vol 8, No 1, p 11-16, 1969. 6 p, 1 fig, 5 tab, 5 ref.

Descriptors: *Droughts, *Statistical methods, *Moisture deficit, Correlation analysis, Probability, Forecasting, Water shortage, Evapotranspiration, Soil moisture, Climatology, Estimating.
Identifiers: New Zealand.

Agricultural drought is defined as existing when the soil moisture in the root zone is at wilting point or below. The occurrence and distribution of agricultural drought was determined for 41 seasons in Mid Canterbury, New Zealand by calculating the day-by-day changes in soil moisture. This calculation was based on a Thornthwaite estimate of daily evapotranspiration modified to allow for the effect of decreasing soil moisture, and programmed for a digital computer. The average number of days of agricultural drought per season was 40, varying from none to 88. Approximately two-thirds of all drought days occurred during the summer months. The distribution of the longest drought in each season conforms to extreme-value theory; this showed that very severe periods of drought of 30 days or more could be expected once every 5 years. Highly significant correlations were obtained between seasonal nonirrigated pasture production and the number of days of agricultural drought. (Knapp-USGS)
W70-01687

DESIGN OF RECIRCULATING IRRIGATION SYSTEMS,
Agricultural Research Service, Kimberly, Idaho. Northwest Branch Soil and Water Conservation Research Div.
James A. Bondurant.
American Society of Agricultural Engineers, Transactions, Vol 12, No 2, 1969, p 195-198, 201. 6 fig, 3 ref.

Descriptors: *Runoff, *Water reuse, *Irrigation systems, *Surface irrigation, *Irrigation efficiency, Irrigation water, Idaho, Farm equipment, Operating costs, Irrigation engineering, Agricultural engineering, Equations, Arid lands, Design criteria, Pumping plants, Cost analysis, Flow rates, Water utilization.
Identifiers: *Recirculating irrigation systems.

Irrigation is necessary for many crops in arid or semiarid regions. When water costs are high or when it is desirable to control surface flow of silt and chemical contaminents in irrigation runoff water, a recirculation system may be considered. When irrigation runoff is collected it should be recirculated to a different field. Maximum improvement in efficiency is achieved by using stored runoff water to reduce stream size for cutback irrigation. A design example is given for an Idaho farm of 105 irrigated acres. A method is presented for determining amount and rates of runoff and time and size of cutback. Since annual operating costs depend to a large extent on design and efficiency of the pumping installation, great emphasis is placed on these factors. The necessary design data are listed and the equations for design calculations are given. (Crouse-Arizona)
W70-01799

ATRIPLEX POLYCARPA: I. GERMINATION AND GROWTH AS AFFECTED BY SODIUM CHLORIDE IN WATER CULTURES,
California Univ., Riverside. Dept. of Agronomy.
For primary bibliographic entry see Field 02I.
W70-01800

COMPARISON OF INDEXES RELATING PLANT RESPONSE TO SOIL MOISTURE STATUS,
Agricultural Research Service, University Park, Pa. Northeast Watershed Research Center; and Hebrew Univ., Jerusalem (Israel). Dept. of Agriculture.
E. Rawitz, and D. I. Hillel.
Agronomy Journal, Vol 61, No 2, March-April 1969, p 231-235. 2 tab, 9 fig, 16 ref.

Descriptors: *Irrigation practices, *Soil-water-plant relationships, *Plant growth, *Soil moisture, *Crop response, Arid lands, Semiarid climates, Tensiometers, Growth chambers, Agronomy, Irrigation efficiency, Moisture availability, Timing, Crop production.
Identifiers: *Israel, *Soil suction, *Capillary suction index, Negev Desert.

Although plant response to soil moisture is affected by many factors, a single-value index is practical for determining timing and amount of irrigation. Comparisons of several indexes were made on the basis of dry matter yield of plants in growth chambers using soils from the arid Negev region of Israel. The mean maximum capillary suction index (using the minimum moisture content of each irrigation cycle) was the most practical. It is a relatively simple measure for a given soil where the affect of modifying factors is known or is fairly constant. The negative yield increment per unit suction decreased sharply to a fairly constant low value after a suction of about 1.5 bars. In the field such conditions are common during summer growing seasons in arid or semiarid Mediterranean climates. For practical field application it is suggested that suction be measured directly by tensiometer or calibrated electrical resistance units. (Crouse-Arizona)
W70-01801

FALL CHISELING FOR ANNUAL CROPPING OF SPRING WHEAT IN THE INTERMOUNTAIN DRYLAND REGION,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center; and Agricultural Research Service, Sidney, Mont. Northern Plains Soil and Water Research Center.
T. W. Massee, and F. H. Siddoway.
Agronomy Journal, Vol 61, No 2, p 177-181, Mar-Apr 1969. 2 tab, 5 fig, 12 ref.

Descriptors: *Dry farming, *Chiselling, *Soil-water-plant relationships, *Wheat, *Fallowing, Cultivation, Plant growth, Soil moisture, Agriculture, Semiarid climates, Idaho, Water utilization, Crop production, Great Plains, Moisture availability.
Identifiers: *Plots, Water use efficiency, Cropping.

Dryland agricultural production is largely limited by available water for plant growth. Various fallowing operations are practised to increase soil water supply for the next crop. An experiment was conducted in Idaho to test the effectiveness on wheat production of annual cropping, annual cropping with fall chiseling, and spring wheat-fallow rotation with chiseling after harvest. Monthly precipitation was a nearly uniform 2.5 cm., but cropping season precipitations averaged only 9.1 cm. In a 180 cm. soil depth annually cropped fall-chiseled plots averaged 21.3 cm. available stored water; cropped-fall chiseled-fallowed plots averaged 22.9 cm; and annually cropped plots averaged only 15 cm. (Crouse-Arizona)
W70-01802

GRASS SEEDING IN THAL, WEST PAKISTAN,
For primary bibliographic entry see Field 02I.
W70-01808

COST-BENEFIT ANALYSIS OF PASTURE IMPROVEMENT IN THE ARID REGION OF RAJASTHAN,
Agro-Economic Research Centre, Vallabh Vidyanagar (India).
N. S. Jodha.
Annals of Arid Zone, Vol 7, No 2, p 250-257, 1968. 2 tab, 8 ref.

Descriptors: *Pasture management, *Range management, *Economic feasibility, *Arid lands, *Cost-benefit analysis, Interest rate, Cost-benefit ratio, Grazing, Range grasses, Contour furrows, Vegetation regrowth, Land reclamation, Data collections.
Identifiers: *Reseeding, *Rajasthan, India.

Nearly 315 of the state of North-Western Rajasthan (about 214,000 sq. kms.) is arid land. The sandy soils are susceptible to erosion and support only sparse vegetation. In spite of increasing competition for crop land, available grazing land decreased while livestock population increased over 50% in the decade from 1951-1961. In order to utilize the limited soil moisture to maintain productive grazing land, scientifically and economically sound range management practices are essential. Experimental studies have developed two methods that offer possibility of raising the productivity of grazing lands: range reseeding and contour furrowing (to conserve moisture). Cost-benefit analysis of both methods is presented using an interest rate of 9 percent. With an estimated project life of 15 years, reseeding had a cost-benefit ratio of 1:3.47, while contour furrowing had a ratio of 1:5 on a ten year basis. (Crouse-Arizona)
W70-01809

AUSTRALIA'S ARID RANGELANDS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
R. A. Perry.
Annals of Arid Zone, Vol 7, No 2, p 244-249, 1968. 2 fig, 9 ref.

Descriptors: *Arid lands, *Range management, *Economic feasibility, *Grazing, *Resource development, Soil-water-plant relationships, Soil moisture, Erosion control, Simulation analysis, Ecosystems, Computers, Ranges, Land tenure, Rainfall, Sheep, Cattle.
Identifiers: *Australia.

Australia's arid lands are defined as those on which rainfall is not adequate for crop production. Seasonal distribution of rainfall, its reliability and evaporative potential together with total rainfall are considered in delineating the area where cropping is not economically feasible. Australia has some 2,2000,000 sq. miles which might be considered arid by the definition used. About half this area consists of sand plains or dune fields unsuitable for grazing. The remainder supports about 4.5 million cattle and 48 million sheep. An extensive system of management is used which gives efficient returns to capital. Carrying capacity must be adjusted in each area to obtain optimum sustained production from the limited available moisture. The land tenure system is unique: all land is owned by state governments and leased on long-term basis. The State retains power to influence land management to the extent that basic knowledge is available. The grazing industry operates in a delicate ecosystem that could easily be upset with irreversible deterioration. An objective of the grazing research program is knowledge of the functional relationships of the ecosystem so that grazing management experiments can be simulated in a computer. (Crouse-Arizona)
W70-01810

IMPROVING SEMIDESERT RANGES IN SOUTHERN ARIZONA, U.S.A. BY GRAZING MANAGEMENT AND SHRUB CONTROL,
Forest Service (USDA), Tucson, Ariz. Rocky Mountain Forest and Range Experiment Station.
S. Clark Martin.
Annals of Arid Zone, Vol 7, No 2, p 235-242, 1968. 2 tab, 2 fig, 12 ref.

Descriptors: *Semiarid climates, *Range management, *Weed control, *Mesquite, *Desert plants, Grasslands, Stocking, Grazing, Arizona, Forage grasses, Southwest U.S., Cacti, Rainfall, Shrubs, Soil moisture.
Identifiers: Burroweed, Perennial grasses.

The 50,000 acre Santa Rita Experimental Range in southern Arizona is representative of nearly 20 million acres of semidesert grass-shrub range in the southwestern U.S. The vegetation which can best utilize limited moisture supply to support economically feasible grazing is perennial grass. Without careful range management, the land is invaded by weed shrubs and small trees which use available soil moisture and permit only limited grazing. Shrubs may be controlled by chemicals or, under certain conditions, by fire. Chemicals applied by ground spray or by air will kill mesquite. When stocking was adjusted to utilize 40% of the forage, yields doubled in three years; when shrubs and mesquite were controlled, grass yields increased 3 1/2 times. When the grasses were allowed to occupy more of the root zone, they were able to utilize for forage production more of the soil moisture before it evaporated. (Crouse-Arizona)
W70-01811

PAPAGO FLOODWATER PASTURES SHOW PROMISE,
Arizona Univ., Tucson; and Bureau of Indian Affairs, Papago Indian Reservation, Ariz.
For primary bibliographic entry see Field 03B.
W70-01813

WATER PRIORITY RIGHTS AND THEIR EFFECT ON FARM PLANNING IN THE SAN CARLOS IRRIGATION AND DRAINAGE DISTRICT IN CENTRAL ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
Aaron G. Nelson, and P. Thomas Cox.
University of Arizona, Agricultural Experiment Station, Technical Bulletin 184, 1968. 48 p, 20 tabs, 4 fig.

Descriptors: *Arizona, *Irrigation districts, *Probability, *Economics, *Water allocation (Policy), Arid lands, Irrigated land, Water rates, Farm prices, Costs, Profits, Institutional constraints, Priorities, Indian reservations, Water storage, Pumped storage, Dams, Watersheds (Basins).
Identifiers: *San Carlos Irrigation and Drainage District (Ariz), *Gila River.

Water is the most limiting factor with which farmers operating in the San Carlos Irrigation and Drainage District in central Arizona must contend. Yet the institutional environment is such that they must make decisions without full knowledge of and only negligible control over their water supply. The objectives of this paper are to increase available knowledge of institutional constraints and reduce uncertainties of decision making. Priorities and apportionment of natural flow and pumped and stored water are described. Probabilities of receiving certain amounts of water in a given period are calculated. From those probabilities graphs were developed to show probable marginal gain and loss per water period for specified crops with different levels of costs and prices. (Crouse-Arizona)
W70-01814

A PRELIMINARY FIELD STUDY OF SURFACE TREATMENTS FOR RUNOFF INDUCEMENT IN THE NEGEV OF ISRAEL,
Hebrew Univ., Jerusalem (Israel). Dept. of Agriculture; and National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 03B.
W70-01820

USE OF CONTROLLED ENVIRONMENT FOR VEGETABLE PRODUCTION IN DESERT REGIONS OF THE WORLD,
Arizona Univ., Tucson. Environmental Research Lab.; and Sonora (Univ.) Hermosillo (Mexico).
Merle H. Jensen, and Marco Antonio Teran.
American Society for Horticultural Science, 66th Annual Meeting, Aug 20-22, 1969, Pullman, Washington, Paper Presented. 12 p, 5 tab.

Descriptors: *Greenhouses, *Arid lands, *Soil-water-plant relationships, *Irrigation efficiency, *Vegetable crops, Irrigation practices, Environmental effects, Fertilization, Plant diseases, Mexico, Calcium, Beaches, Leaching, Plastics, Pollen, Pest control, Nutrients, Planting management, Saline water, Sands.
Identifiers: *Controlled environment, *Sonora, Mexico, Gulf of California, Puerto Penasco.

The authors report on a pilot program to grow a variety of edible vegetables in a controlled environment on the arid coast of Sonora, Mexico at Puerto Penasco. Air-inflated plastic greenhouses are used

to minimize consumption of scarce fresh water and provide protection from insects and sandstorms. Beach sand is used as a medium after leaching to remove excess salts. Nutrients are supplied through the irrigation system. Air inside the greenhouse is circulated through a spray of seawater which maintains relative humidity close to 100%, and reduces fresh water irrigation requirements to a minimum. Yields were high - comparable to those of conventional greenhouses. Disease problems were limited to easily controlled fungus infection. (Crouse-Arizona)
W70-01822

THE GEZIRA SCHEME: A STUDY IN AGRICULTURAL DEVELOPMENT,
William A. Hance.
In: William A. Hance, African Economic Development, Rev ed, New York, Praeger, 1967, p 31-53.

Descriptors: *Arid lands, *Land tenure, *Irrigation operation and maintenance, *Marketing, *Agriculture, Diversion dams, Irrigation practices, Hydroelectric plants, Farm management, Clays, Social impact, Economic impact, Cotton, Multipurpose projects.
Identifiers: *Sudan, *Africa, *Nile River, *Gezira Scheme.

The Gezira Scheme which started in the 1920's, lies south of Khartoum, Sudan, between the White Nile and Blue Nile. The naturally arid land is irrigated by diversion from the Blue Nile. A total area of about 1,870,000 acres is involved, of which about 58 percent is irrigated each year. Principal crops are cotton and food and feed grains. Average tenancy is about 30 acres and is worked largely by hand methods. Most of the land is government owned but alloted to and worked by original residents of the area. It is worked under a partnership arrangement among tenants, government and public utilities which manages the water works, marketing and research and which offer managerial guidance. General economic and educational levels of tenants and hired help have been raised to a favorable level and needed revenues are derived by the government, although individual initiative has been limited by the partnership arrangement. The scheme has been copied elsewhere in Africa with varying degrees of success and offers at least one workable approach to agricultural development of the arid zones of Africa. (Crouse-Arizona)
W70-01823

BORON TOLERANCE OF TALL WHEATGRASS,
Department of Agriculture, Lincoln, Nebr.
Gerald E. Schuman.
Agronomy Journal, Vol 61, No 3, May-June 1969, p 445-447. 1 tab, 4 fig, 7 ref.

Descriptors: *Boron, *Wheatgrasses, *Arid lands, *Plant growth, *Toxicity, Germination, Nutrients.
Identifiers: *Boron toxicity, Nutrient culture.

Some of the unproductive arid lands of the western United States have less vegetation than actual rainfall might support because of high boron levels in the soil. Experiments were conducted with three varieties of tall wheatgrass in nutrient solutions with boron content ranging from 0 to 150 ppm. One variety, Alkar, was also tested in sandy loam. In the nutrient solutions the B level, which effected a 50% reduction in growth, ranged from 33 to 38 ppm. Growth of the Alkar variety in soil was reduced to 50% at a B level of 46 ppm in the saturation extract. The author concluded that tall wheatgrass may be economically feasible for reseeding arid land with boron levels as high as 35 ppm. Germination was not adversely affected by boron in the soil. (Crouse-Arizona)
W70-01825

PLANT DENSITY AND YIELD OF SUGAR BEETS IN AN ARID ENVIRONMENT,
California Univ., Davis. Dept. of Water Science and Engineering; and California Univ., Davis. Dept. of Agronomy.
Frank E. Robinson, and George F. Worker, Jr.
Agronomy Journal, Vol 61, No 3, May-June 1969, p 441-443. 5 tab, 1 fig, 20 ref.

Descriptors: *Sprinkler irrigation, *Arid lands, *Sugar beets, *California, *Crop production, Germination, Crop response, Spatial distribution, Plant populations.
Identifiers: Dry matter, Sucrose.

Use of sprinkler irrigation permits flexibility in spacing arrangements and density of plants. An experiment testing four different spacings of sugar beet plants was run to determine the yield of sucrose in relation to plant density per hectare of sprinkler irrigated arid land. The highest yield of sucrose with square grid spacing was obtained with approximately 100,000 plants per hectare. Maximum yield spacing for the sprinkler irrigated arid area tested was similar to that found in well watered European regions. (Crouse-Arizona)
W70-01827

SPRINKLER IRRIGATION IN ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Engineering.
A. D. Halderman, and K. R. Frost.
Arizona University, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-56, Dec 1968. 30 p, 13 fig, 3 tab.

Descriptors: *Arid lands, *Arizona, *Sprinkler irrigation, *Irrigation design, *Irrigation systems, Economic justification, Initial costs, Operating costs, Temperature control, Frost protection, Agricultural engineering, Cost analysis, Irrigation efficiency.

Sprinkler irrigation is considered as a method of improving efficiency of water use by agriculture in arid Arizona. This bulletin is intended to supply growers with information needed to make decisions concerning installation of sprinkler irrigation systems. Advantages include possibilities of irrigating rough land; light, frequent irrigations for better soil moisture control; relatively uniform and efficient distribution; alleviation of soil erosion and excessive loss to deep percolation; more efficient field machinery operations; frost control; and fertilizer application. However, additional power is required to provide pressure and initial installation may be more costly. Diagrams, tables and discussion are presented to guide the operator in decisions on system design, selection of type of system, volume of water required, operation, and economics of sprinkler irrigation. (Crouse-Arizona)
W70-01832

BASIC PROBLEMS OF THE TRANSFORMATION OF NATURE IN CENTRAL ASIA,
Akademiya Nauk SSSR, Moscow. Institut Goegrafii.
I. P. Gerasimov.
Translation from Problemy Osvoyeniya Pustin, No 5, p 3-17, 1967. Soviet Geography: Review and Translation Vol 9, No 6, p 444-458, June 1968. 1 tab.

Descriptors: *Grazing, *Arid lands, *Soil surveys, *Irrigable land, *Agriculture, History, Range management, Soil types, Semiarid climates, Runoff, Saline soils, Resource development, Hydrologic cycle, Water balance, Land reclamation, Drainage, Geographic regions, Salt balance.
Identifiers: *U.S.S.R., *Central Asia, *Physical geography.

The author presents a broad view of the problems involved in rational expansion of irrigated agriculture and grazing in Central Asia to their full potential. Present investigations are of two types: historical and soil and physical-geographic studies. Historical research indicates that at one time 8-10 million ha. were irrigated at sometime in Central Asia, far more than at present. Assuming current technology, at least 10.2 million ha. in desert and semiarid regions of Central Asia are irrigable. Many soil types are involved, including large areas with salinity problems. Grazing lands that have permanent forage plants might support 25-30 million sheep - far more than present flocks. Dependable watering installations and better surveys of natural productivity of grazing lands are needed to meet this potential. The Institute of Geography has attempted to define problems requiring interdisciplinary research to achieve the full potential of Central Asia. (Crouse-Arizona)
W70-01836

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MAN AND NATURE AT ODDS IN THE DELTA,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 06G.
W70-01642

DIVERSION BY LAKE PIERCING, SNETTISHAM PROJECT,
Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 08B.
W70-01661

THE PREDICTION OF EVAPORATION, DRAINAGE, AND SOIL WATER STORAGE FOR A BARE SOIL,
Wisconsin Univ., Madison. Dept. of Soil Sciences.
For primary bibliographic entry see Field 02G.
W70-01664

FLOOD PLAIN INFORMATION OF YELLOWSTONE RIVER: VOLUME 1 - BILLINGS METROPOLITAN REGION, MONTANA,
Corps of Engineers, Omaha, Nebr.

Corps Eng Flood Plain Rep, Oct 1969. 17 p, 8 plate, 5 tab.

Descriptors: *Flood, *Flood damage, *Montana, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Yellowstone River (Mont), Billings (Mont), Standard project flood, Intermediate regional flood.

Flooding of the Yellowstone River, Billings, Montana is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01681

FLOOD PLAIN INFORMATION, KENAI RIVER, ALASKA.
Corps of Engineers, Anchorage, Alaska.

Corps Eng Flood Plain Rep, Apr 1967. 11 p, 1 fig, 5 exhibit, 25 map, 17 ref.

Descriptors: *Floods, *Flood damage, *Alaska, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.

Identifiers: Kenai River (Alaska), Standard project flood, Intermediate regional flood.

Flooding of the Kenai River, Alaska is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01682

FLOOD PLAIN INFORMATION, SHENANDOAH RIVER, CLARKE COUNTY, VIRGINIA.
Corps of Engineers, Baltimore, Md.

Corps Eng Flood Plain Rep, Feb 1969. 25 p, 3 fig, 12 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Virginia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Shenandoah River (Va), Clarke County (Va), Standard project flood, Intermediate regional flood.

Flooding of the Shenandoah River in Clarke County, Virginia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-01683

BULKHEAD LINE: THE LIFELINE OF OUR COASTS,
Tom Adams.
In the Capitol, Vol 7, No's 9, 10, p 1-3, Sept, Oct 1969. 3 p.

Descriptors: *Florida, *Bulkhead line, *Landfills, *Water pollution, Coasts, Coastal engineering, Coastal structures, Shores, Shore protection, Land forming, Land reclamation, Land management, Land resources, Administration, Legislation.
Identifiers: Recommended legislation.

The bulkhead line is an imaginary line in a body of water beyond which no land filling is permitted. Bulkhead lines are important to Florida because haphazard filling can cause water pollution and the destruction of marine and bird sanctuaries. The Trustees of the Internal Improvement Fund manage Florida's coastal land resources. They have established a uniform policy on bulkhead lines based on the mean high water mark. The Trustees have set penalties for illegally filling coastal areas. However, permanent legislation is needed to establish bulkhead lines and construction setback lines along our coastlines. (McDonough-Florida)
W70-01704

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W70-01772

DESIGN OF RECIRCULATING IRRIGATION SYSTEMS,
Agricultural Research Service, Kimberly, Idaho. Northwest Branch Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
W70-01799

THE ACHIEVEMENTS OF DRAINAGE THEORY IN RELATION TO PRACTICAL NEEDS: TAKING STOCK,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
For primary bibliographic entry see Field 02G.
W70-01817

REGIONAL CONSIDERATION OF FLOOD PLAIN PLANNING,
Bi-State Metropolitan Planning Commission for Scott County, Iowa and Rock Island County, Ill.
For primary bibliographic entry see Field 06B.
W70-01837

TECHNIQUES FOR DEVELOPING A COMPREHENSIVE PROGRAM FOR FLOOD PLAIN MANAGEMENT,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 06B.
W70-01838

MAN SHOULD MANAGE THE FLOOD PLAINS,
For primary bibliographic entry see Field 06B.
W70-01839

PAPER: (TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY),
Buenos Aires Univ. (Argentina).
For primary bibliographic entry see Field 06B.
W70-01844

PAPER: (TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY) (IN FRENCH),
Bundesverkehrsministerium, Bonn (West Germany).
For primary bibliographic entry see Field 06B.
W70-01845

GENERAL REPORT: (METHODS FOR ASSESSING THE TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY),
Ingenieur General dea Ponts et Chaussees.
For primary bibliographic entry see Field 06B.
W70-01846

PAPER: (DETERMINING THE CAPACITY OF THE ST. LAWRENCE SEAWAY),
St. Lawrence Seaway Development Corp.
For primary bibliographic entry see Field 06D.
W70-01847

PAPER: (TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY),
Netherlands Rijkswaterstaat, The Hague.
For primary bibliographic entry see Field 06B.
W70-01848

PAPER: (TRANSPORT CAPACITY OF AN ARTIFICIAL WATERWAY) (IN FRENCH),
Navigazione Interna e Trasporti Internazionali, Milan (Italy).
For primary bibliographic entry see Field 06B.
W70-01849

PAPER: (EVALUATION OF THE TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY) (IN FRENCH),
For primary bibliographic entry see Field 06B.
W70-01850

THEORY AND EXPERIMENT IN CANAL SEEPAGE ESTIMATION USING RADIOISOTOPES,
Bhabha Atomic Research Center, Bombay (India). Isotope Div.
For primary bibliographic entry see Field 02G.
W70-01858

DRAINAGE DESIGN THEORY AND PRACTICE,
Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experiment Unit.
For primary bibliographic entry see Field 02A.
W70-01877

DRAINAGE DENSITY AS AN INDICATOR OF BASE FLOW IN PART OF THE POTOMAC RIVER BASIN,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-01896

AQUATIC WEED CONTROL WITH SODIUM ARSENITE,
Wisconsin State Board of Health, Madison. Committee on Water Pollution.
For primary bibliographic entry see Field 05G.
W70-01939

SHORE DEVELOPMENT AND PRESERVATION.
For primary bibliographic entry see Field 06E.
W70-01997

SURVIVAL OF QUERCUS TURBINELLA AND Q. EMORYI SEEDLINGS IN AN ARIZONA CHAPARRAL COMMUNITY,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
C. P. Pase.
Southwestern Naturalist 14 (2):149-155, Oct 10, 1969.

Descriptors: *Chaparral, *Oak trees, *Succession, Effects, Competition, Growth stages, *Burning, Environmental phenology.
Identifiers: *Prescribed fire, Seedling establishment.

Naturally occurring seedlings of shrub live oak (Quercus turbinella) and Emory oak Q. emoryi are uncommon, but a moderate population was observed in August 1963 on chaparral strips burned 1 and 2 years previously. After 3 years, survival of shrub live oak seedlings was 26 percent, and Emory oak, 27 percent. Nearly all mortality was attributed to drought. It is hypothesized that rainfall is suitable for oak seedling germination and establishment only 1 year in 10. Critical moisture values suggested are 15 inches or more of October-March precipitation, followed by 10 inches or more of July-September rainfall. (Author)
W70-02041

4B. Groundwater Management

ARTIFICIAL RECHARGE TO THE SNAKE PLAIN AQUIFER IN IDAHO; AN EVALUATION OF POTENTIAL AND EFFECT,
Geological Survey, Washington, D.C.
R. F. Norvitch, C. A. Thomas, and R. J. Madison.
Idaho Dep Reclam Water Inform Bull No 12, Aug 1969. 59 p, 14 fig, 3 tab, 26 ref.

Descriptors: *Water resources development, *Artificial recharge, *Water management (Applied), *Analog models, *Idaho, Aquifers, Hydrogeology, Streamflow, Groundwater movement, Water quality, Water levels, Discharge (Water), Hydrologic data, Data collections, Water wells, Permeability, Transmissivity.
Identifiers: Snake River Plain aquifer (Idaho).

The major factors involved in using surplus water for artificial recharge of the Snake Plain aquifer in southern and southeastern Idaho are the availability of water, the effects of mixing on groundwater quality and aquifer properties, and the effects of artificial recharge on groundwater levels and discharge. About 5,100,000 acre-ft of water is recharged to the aquifer annually by irrigation. An average flow of about 1.3 million acre-ft or more

occurs at a rate of once every 2 yr. There probably will be no chemical-quality problems involved in large-scale recharge. A transient state, electric-analog model of the Snake Plain aquifer was constructed. Model predictions show that by recharging a total of 3.7 million acre-ft of water over a 10-yr period at 4 different places on the Plain, water-level rises of less than 1 to more than 5 ft, measured 21 months after recharge stopped, would occur. If water were added at 62,000 acre-ft per month for 3 continuous months at each place, once every 2 yr, over a 10-yr period, 3.3 million acre-ft would go into storage in the aquifer and 0.4 million acre-ft would flow out of the springs. (Knapp-USGS)
W70-01654

ARTIFICIAL GROUNDWATER RECHARGE - WET WALNUT CREEK,
Geological Survey, Lawrence, Kans. Water Resources Div.; and Kansas Water Resources Board, Topeka.
J. B. Gillespie, K. L. Lindskov, and S. E. Slagle.
Kans Water Resources Board Progr Rep No 1, Jan 1969. 22 p, 5 fig, 2 append.

Descriptors: *Artificial recharge, *On-site tests, On-site investigations, Water spreading, Irrigation water, Monitoring, Data collections, Hydrologic data.
Identifiers: Aquifer testing, Recharge ponds.

Preliminary work on an artificial recharge project at Wet Walnut Creek, Rush County, Kansas includes damsite studies, aquifer core sampling, collection of drillers' logs of wells in the area, and drilling of observation wells for aquifer testing. The available driller's log and core test information is tabulated. Descriptions are given of the work accomplished to date at each test site. (Knapp-USGS)
W70-01659

WATER RESOURCES APPRAISAL OF THE WARM SPRINGS--LEMMON VALLEY AREA, WASHOE COUNTY, NEVADA,
Nevada State Dept. of Conservation and Natural Resources, Carson City.
For primary bibliographic entry see Field 03B.
W70-01806

A BRIEF APPRAISAL OF THE WATER RESOURCES OF THE WALKER LAKE AREA, MINERAL, LYON, AND CHURCHILL COUNTIES, NEVADA,
Nevada State Dept. of Conservation and Natural Resources, Carson City.
For primary bibliographic entry see Field 03B.
W70-01807

PROJECTIONS OF NET INCOME AND WATER USE IN PINAL COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
William E. Martin, Thomas G. Burdak, and Robert A. Young.
Progressive Agriculture in Arizona, Vol 21, No 4, July-Aug 1969, p 3, 20. 1 tab.

Descriptors: *Agriculture, *Arizona, *Economics, *Net income, *Computers, Irrigation, Groundwater mining, Cost trends, Farm management, Linear programming, Analog computers, Digital computers, Arid lands, Water levels, Water table, Water utilization, Pumping.

Large-scale use of groundwater for irrigation in arid Pinal County of central Arizona has caused a rapid decline in water level. As the water level falls, pumping costs rise. The authors combined analog computer projections of the groundwater table made by the U.S. Geological Survey with a digital computer linear programming technique to obtain water use and cost projections based on the interrelated nature of agriculture and aquifer conditions. It was recognized that as pumping costs increase, farmers will change their agricultural activities. The conclusion was that while the water table will continue to decline, the rate will slow down in response to higher costs. Net farm income will decline gradually, with smaller farms most seriously affected. (Crouse-Arizona)
W70-01812

THE ORIGIN AND SPREAD OF QANATS IN THE OLD WORLD,
Texas Univ., Austin, Tex.
Paul Ward English.
American Philosophical Society, Proceedings, Vol 112, No 3, June 1968, p 170-181. 4 fig, 74 ref.

Descriptors: *Wells, *Underground structures, *Irrigated land, *Arid lands, Water rights, Water table, Social change, Construction costs, Tunneling, Institutional constraints, Water law.
Identifiers: *Qanats, *Armenia, *Persia (Iran), Arabia, North Africa, Central Asia, China.

The author reviews probable origin of the Qanat system more than 2,500 years ago in the region of Armenia and its spread to arid regions of Persia, Egypt, Arabia, North Africa, Central Asia, and even China. Qanats are gently sloping tunnels dug by hand down into an allovial fan until they intercept the water table. Water emerges in nearby lowlands, where it is used for irrigation and domestic purposes. In use over long periods, Qanats have influenced settlement patters and agriculture and have a complex set of customs that determine water rights. Although deep wells may be less costly to construct today, large numbers of existing Qanats exert a conservative force in support of continued existence of preindustrial social and economic conditions. (Crouse-Arizona)
W70-01830

OBSERVATIONS OF THE PRESSURE SURFACE IN THE AQUIFER OF AN IRRIGATION DISTRICT AT MERBEIN, AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Merbein (Victoria). Div. of Horticultural Research.
For primary bibliographic entry see Field 02F.
W70-01857

BASE FLOW WELLS: RIO COBRE PROJECT, JAMAICA,
Humphreys (Howard) and Sons, Reading (England); and Water Research Association, Medmenham (England).
J. D. Williams, and A. Hunter Blair.
J Inst Water Eng, Vol 23, No 7, p 449-463, Oct 1969. 15 p, 6 fig, 2 tab, 6 ref.

Descriptors: *Conjunctive use, *Base flow, *Groundwater, *Karst, *Analog models, *Low-flow augmentation, Model studies, Water wells, Alluvial channels, Pumping, Springs, Water supply, Water resources development.
Identifiers: *Jamaica (BWI), Rio Cobre (Jamaica).

To augment the resources of Kingston and St. Andrew, Jamaica, an inexpensive groundwater scheme, the Rio Cobre project, involves the development of three groundwater sources. Use of one of these sources, Tulloch Spring, would reduce the river flow available to the Rio Cobre irrigation system. An electric analog model was constructed to verify that seasonal pumping from groundwater storage can maintain the river base flow and compensate for abstraction at the spring. After modelling historic data, the performance of several alternative groups of base flow wells was tested. River flows can be maintained without impairing other interests in the aquifer, and the valuable Tulloch source can be developed as part of the project in this manner. (Knapp-USGS)
W70-01891

HYDROGEOLOGIC RECONNAISSANCE OF THE CANARY ISLANDS, SPAIN,
Geological Survey, Lawrence, Kan.; and Ministry of Public Works (Canary Islands).
For primary bibliographic entry see Field 02F.
W70-01901

4C. Effects on Water of Man's Non-Water Activities

REVERSE AND DIRECT RESERVOIR ROUTING METHOD SETS HIGHWAY GRADE,
Ministry of Public Works, Caracas (Venezuela).
Constantine Voutyras.
Civil Eng, Vol 39, No 10, p 56-58, Oct 1969. 3 p, 4 fig, 1 photo.

Descriptors: *Routing, *Streamflow, *Floods, *Stage-discharge relations, *Embankments, Hydraulic design, Weirs, Discharge coefficients, Drainage, Spillway crests, Highway effects, Water levels, Overflow.
Identifiers: Rating curves, Venezuela.

Combined overflows from the Orinoco and Apure Rivers in Venezuela produced unprecedented flooding in the vicinity of a highway that was under construction. The partially built embankment acted as a dam, and because the flood was without precedence, the drainage system designed for the highway proved inadequate. The problem of providing proper drainage was aggravated by a lack of topographic and hydrologic data for the area. Information was gathered on water levels, high water marks and topography in the vicinity. By treating the embankment as a broad-crested weir, a rating curve for the 2.5-km (1.6-mile) spillway was developed, and an outflow hydrograph constructed from stage-discharge relationships. Then, employing reverse routing methods, an inflow hydrography was established. Repeated routing of this hydrograph was used in developing one graph of water elevation and total waterway span, from which the total drainage waterway opening required to prevent overtopping of the road was determined. (Knapp-USGS)
W70-01660

A MUDFLOW IN THE SECOND CREEK DRAINAGE, LAKE TAHOE BASIN, NEVADA, AND ITS RELATION TO SEDIMENTATION AND URBANIZATION,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02J.
W70-01899

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

MICROPARTICULATES: ISOLATION FROM WATER AND IDENTIFICATION OF ASSOCIATED CHLORINATED PESTICIDES,
Ohio State Univ., Columbus. Dept. of Microbial and Cellular Biology.
R. M. Pfister, P. R. Dugan, and James I. Frea.
Science, Vol 166, No 3907, p 878-879, Nov 1969. 2 p, 1 tab, 7 ref. OWRR Grants A-006-OHIO and A-013-OHIO.

Descriptors: *Pesticide kinetics, *Lakes, *Adsorption, *Suspended load, Gas chromatography, Path of pollutants, Pesticide residues, Laboratory tests, Sampling, Analytical techniques, Chlorinated hydrocarbon pesticides.
Identifiers: Microparticulates, Gas-liquid chromatography, Thin-layer chromatography.

Microparticulates suspended in lake water were collected by continuous centrifugation and either examined directly or placed on a linear sucrose gradient. Total residue as well as fractions of the centrifuged gradient were extracted with hexane and examined by gas chromatography for the presence of chlorinated hydrocarbon pesticides. Hexane extracts of total residues were also examined by thin-layer chromatography. Lindane and endrin were shown, by gas-liquid chromatography and thin-layer chromatography, to be associated with microparticles. These and other pesticides appeared to be selectively associated with microparticles of different densities, when gas-liquid chromatography was used, although concentrations were below the detection limits required for confirmation by thin-layer chromatography. Samples taken at different times from different locations in Lake Erie revealed different associations with hexane-soluble electron-capturing compounds. (Knapp-USGS)
W70-01669

DUAL COLUMN AND DERIVATIVE TECHNIQUES FOR IMPROVED SPECIFICITY OF GAS-LIQUID CHROMATOGRAPHIC IDENTIFICATION OF ORGANOCHLORINE INSECTICIDE RESIDUES IN SOILS,
Wisconsin Univ., Madison. Dept. of Soil Science.
H. B. Pionke, G. Chesters, and D. E. Armstrong.
Analyst, Vol 94, No 1123, p 900-903, Oct 1969. 4 p, 2 fig, 1 tab, 8 ref. Contract No 12-14-100-8154 (41), Agricultural Research Service.

Descriptors: *Analytical techniques, *Gas chromatography, *Insecticides, DDT, Instrumentation, Water analysis, Pollutant identification, Soil chemistry, Soil water.
Identifiers: TDE, Methoxychlor.

Derivatives of organochlorine insecticides exhibiting column time values substantially different from those of the parent insecticides were obtained for TDE, methoxychlor, and DDT on treatment with 2% ethanolic potassium hydroxide, and for endrin and dieldrin with ethanolic concentrated hydrochloric acid; partial clean-up of soil extracts was achieved by the alkali treatment. The use of dual colums, namely DC-200 and diethylene glycol succinate, in conjunction with derivative formation, provided column time values sufficiently different for improved organochlorine insecticide identification with minimal additional effort. (Knapp-USGS)
W70-01692

INVESTIGATION OF ORGANIC POLLUTION OF SURFACE WATERS BY ULTRAVIOLET SPECTROPHOTOMETRY,
Hydraulic Research Inst., Ostrava (Czechoslovakia).
Miroslav Mrkva.
J Water Pollut Contr Federation, Vol 41, No 11, Part 1, p 1923-1931, Nov 1969. 9 p, 5 fig, 2 tab, 22 ref.

Descriptors: *Pollutant identification, *Water pollution, *Organic wastes, *Spectrophotometry, *Ultraviolet radiation, Pollutants, Water pollution sources, Sampling, Laboratory tests.
Identifiers: Ultraviolet spectrophotometry.

To determine the organic content of surface waters, several methods may be employed, including ultraviolet spectrophotometry. Assuming that surface waters consist mainly of readily degradable organics and other lignum substances, three groups of surface water classifications were proposed. Absorbance spectra for each of the three ranges were 220 to 245 millimicrons for clean waters; 220 to 280 millimicrons for rivers with high concentrations of lignum sulfonates; and 270 millimicrons for rivers which received additional waste products (phenol, etc.). Coefficients to convert absorbance to organic concentration are given. Experiments to confirm the proposed wavelengths were performed on the river Odra in the Central European region showed that spectrophotometry can be used to describe the dissolved organic matter in rivers. (Knapp-USGS)
W70-01694

DEGRADATION OF SELECTED CHLORINATED HYDROCARBON INSECTICIDES,
Auburn Univ., Ala. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W70-01696

DDT IN ANTARCTIC SNOW,
Ohio State Univ., Columbus. Dept. of Environmental Science.
Tony J. Peterle.
Nature, Vol 224, No 5219, p 620, Nov 1969. 1 p, 21 ref.

Descriptors: *Pesticide residues, *Antarctic, *Snow, *DDT, Gas chromatography, Sampling, Surveys, Pesticide drift, Persistence.
Identifiers: *Antarctic snow, DDT residues.

Snow which fell in the Antarctic in 1966 and 1967 was collected and analyzed for DDT. Gas chromatography and thin-layer chromatography detected DDT in 3 of the 5 samples tested at levels of about 0.04 ppb. (Knapp-USGS)
W70-01697

A CLASSIFIED BIBLIOGRAPHY OF OIL POLLUTION,
University Coll. of Swansea (Wales). Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W70-01787

MAN-MADE CARBON-14 IN DEEP PACIFIC WATERS: TRANSPORT BY BIOLOGICAL SKELETAL MATERIAL,
Scripps Institution of Oceanography, La Jolla, Calif.; and Tata Inst. of Fundamental Research, Bombay (India).
B. L. K. Somayajulu, D. Lal, and S. Kusumgar.
Science, Vol 166, No 3911, p 1397-1399, Dec 1969. 3 p, 1 tab, 10 ref.

Descriptors: *Carbon radioisotopes, *Pacific Ocean, *Calcium carbonate, *Carbon cycle, *Fallout, Radioactive dating, Radioecology, Radiochemical analysis, Radioactivity effects, Tracking techniques, Sedimentation, Geochemistry.
Identifiers: Pacific Ocean carbon-14.

Calcareous particles present in Pacific waters at depths of 50 to 3500 meters were collected by filtering seawater through spongin matrix. The specific activity of carbon-14 could be measured in two of these collections from depths of 2300 and 3500 meters. The ratios of carbon-14 to carbon-12 correspond to values observed in surface waters in recent years as a result of the addition of manmade carbon-14, thus indicating that the calcareous particles resulted from recent biological productivity. The results are related to the mean settling rates and the sizes and dissolution rates of biogenic calcareous particles in transit through a seawater column. (Knapp-USGS)
W70-01871

FLOW-THROUGH SAMPLING SYSTEM FOR SMALL BOATS OR ICE SHELTER,
Geological Survey, Washington, D.C.; and Geological Survey, Fort Wayne, Ind.
For primary bibliographic entry see Field 07B.
W70-01900

THERMAL POLLUTION AS A FACTOR IN POWER PLANT SITE SELECTION,
Rice (Cyrus Wm.) and Co., Pittsburgh, Pa.; and Gurnham, Bramer and Associates.
P. V. Morgan, and H. C. Bramer.
Paper presented at the Cooling Towers Institute Meeting-1969. 22 p, 2 tab, 2 fig, 3 ref.

Descriptors: *Thermal pollution, Ecology, Powerplants, Temperature, Model studies.
Identifiers: Site selection, Dispersion studies.

Industry today must determine that present or projected effluents will meet the water quality criteria set for receiving streams. This is of particular importance insofar as thermal pollution in connection with electric power generation is concerned. Baseline ecological and engineering studies should be integral parts of site selections and should precede land acquisition or construction planning. The power industry should be continually acquiring data as a matter of self interest to guard against unfounded charges and to institute optimum, least-cost abatement measures. Simultaneous measurements of a biological, chemical and physical nature allow ecological judgements to be made. Other techniques include aerial surveillance with infrared and other photographic monitoring, hydrological measurements, dye dispersion studies, mathematical and physical modeling, data processing, and economic evaluations. Such problems require a true multi-disciplinary approach by a group of scientific and engineering specialists. (Upadhyaya-Vanderbilt)
W70-01923

TDE RESIDUES IN CLEAR LAKE ANIMALS,
California State Dept. of Fish and Game, Sacramento. Wildlife Management Branch; and California State Dept. of Public Health, Sacramento. Food and Drug Lab.
For primary bibliographic entry see Field 05C.
W70-01935

OIL DISPERSING CHEMICALS, A STUDY OF THE COMPOSITION, PROPERTIES AND USE OF CHEMICALS FOR DISPERSING OIL SPILLS,
Federal Water Pollution Control Administration, Edison, N.J. Water Quality Lab.
For primary bibliographic entry see Field 05G.
W70-02037

5B. Sources of Pollution

PESTICIDES IN DRINKING WATER: WATERS FROM THE MISSISSIPPI AND MISSOURI RIVERS,
Consumer Protection and Environmental Health Service, Cincinnati, Ohio.
For primary bibliographic entry see Field 05F.
W70-01643

BEHAVIOR OF NONCONSERVATIVE POLLUTANTS IN AQUEOUS ENVIRONMENTS,
Washington Univ., St. Louis, Mo. School of Engineering.
Ervin Y. Rodin.
J Water Pollut Contr Federation, Vol 41, No 11, Part 2, p R475-R481, Nov 1969. 7 p, 2 fig, 6 ref.

Descriptors: Water pollution effects, *Great Lakes, *Biodegration, *Reviews, Oxidation, Path of pollutants, Eutrophication, Mathematical models, Nutrients, *Water pollution sources.
Identifiers: Nonconservative pollutants.

A qualitative theory for the description of pollution concentration, buildup, and recovery levels is developed. Pollutants of a nonconservative type (i.e., organic matter, phosphates, etc.) are considered, and the Great Lakes are studied. Rainey's formulations are discussed and evaluated. The theoretical approach presented has the advantage over other methods because it is able to uncover the guiding principles of the process and because it can define effective pollutional levels. (Knapp-USGS)
W70-01688

SYSTEMS ANALYSIS FOR OPTIMAL WATER QUALITY MANAGEMENT,
Federal Water Pollution Control Administration, Edison, N.J.
Ethan T. Smith, and Alvin R. Morris.
J Water Pollut Center Federation, Vol 41, No 9, p 1635-1646, September 1969. 12 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Systems analysis, *Mathematical models, *Optimization, *Water quality control, *Water resources development, Cost allocation, Estuaries, Cost-benefit analysis, Delaware River, Biochemical oxygen demand, Dissolved oxygen, Maintenance.
Identifiers: Uniform treatment.

A comprehensive study of the Delaware Estuary was undertaken in 1961 with the following objectives: (a) to develop methods of water quality management, (b) to determine the cause and effect relationship between pollution from any source and the deteriorated quality of water in the estuary and (c) to prepare a program for the improvement and maintenance of the water quality in the estuary was developed which embodied the cause and effect relationships and control programs based on cost allocation, cost minimization and zoned-optimization models. The optimization model of the estuary was formulated as a combination of the uniform treatment and the cost minimization programs. One of the most significant cause and effect relationships evaluated was that between biochemical oxygen demand and dissolved oxygen. For any given objective set the cost minimization model yielded the smallest cost and uniform treatment model yielded the largest. Certain monetary benefits could be derived from increased use of the estuary once its water quality was improved. (Thiuri-Cornell)
W70-01766

STOCHASTIC MODELS FOR BIOCHEMICAL OXYGEN DEMAND AND DISSOLVED OXYGEN IN ESTUARIES,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
Stephen W. Custer, and Richard G. Krutchkoff.
Water Resources Center, Virginia Polytech Inst, Bull 22, February 1969. 232 p, 41 fig, 8 tab, 64 ref, 3 append. FWPCA Grant WP-01216 under FWPCA Program 16090. OWRR Project A-027-VA. Available from the Clearinghouse as PB 188 094 $3.00 in paper copy, $0.65 in microfiche.

Descriptors: *Stochastic processes, *Biochemical oxygen demand, *Dissolved oxygen, *Estuaries, *Numerical analysis, Diffusion, Computer programs, Decision making, Dispersion, Downstream, Water quality.
Identifiers: Traumatic peaks.

Two distinct stochastic models, the Non-Dispersion Model and the Diffusion Model were developed for determining the biochemical oxygen demand (BOD) and dissolved oxygen (DO) probability distribution in an estuary. The mean BOD and DO concentrations were functions of time and space, hence the probability distributions were also temporally and spatially dependent. A computer program was employed to summarize the results in a concise form so that it could be used in the overall decision process. Information for a given point in space was obtained five miles downstream from the source. The mean BOD and DO levels were obtained for each increment of the tidal cycle. The frequency of the concentration above each critical value was obtained. A comparison of the numerical results revealed that the traumatic peaks observed for the non-dispersion model were obliterated in the diffusion model. In the light of the numerical results it concluded that the non-diffusion model was inadequate for describing the astuary situation. The diffusion model was verified on water quality survey data for the Potomac estuary. (Thiuri-Cornell)
W70-01774

GENERALIZED INITIAL CONDITIONS FOR THE STOCHASTIC MODEL FOR POLLUTION AND DISSOLVED OXYGEN IN STREAMS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
Richard H. Moushegian, and Richard G. Krutchkoff.
Water Resources Res Center, Virginia Polytech Inst, Bull 28, p 1-88, August 1969. 88 p, 6 fig, 17 tech, 7 ref, 3 append. NIH Training Grant ES-00033-06; FWPCA Research Grant WP-01216-01 for Program 16090. OWRR Project A-027-VA. Available from the Clearinghouse as PB 188 095 $3.00 in paper copy, $0.65 in microfiche.

Descriptors: *Stochastic processes, *Dissolved oxygen, *Biochemical oxygen demand, *Pollutant identification, *Streamflow, Computer programs, Density stratification, Parametric hydrology, Distribution patterns, Water quality, Probability, Standards.
Identifiers: Initial conditions.

A stochastic model was developed and used to predict the biochemical oxygen demand (BOD) and dissolved oxygen (DO) concentrations at several points downstream of a waste discharge. The model used provided a joint density function for both pollution and dissolved oxygen with given initial conditions. The initial conditions were generalized to permit the output for one stream segment to be the initial conditions for the succeeding stream segment. Interest was focused on the measurement of the marginal distribution of BOD and DO along a stream stretch whose parameters may change at known locations. A computer program assisted in the calculations to obtain marginal distributions. The program allowed for changes in parameter values between one stream segment and the next and could predict distributions for any intermediate locations along the river. The application of this study lay in the analysis of an entire stream stretch to determine if it was healthy for the users within certain preset probabilistic standards. (Thiuri-Cornell)
W70-01775

THE BIOLOGICAL EFFECTS OF OIL POLLUTION ON LITTORAL COMMUNITIES. PROCEEDINGS OF A SYMPOSIUM, ORIELTON FIELD CENTRE, PEMBROKE, WALES, 17-19, February, 1968.
For primary bibliographic entry see Field 05C.
W70-01776

WATER POLLUTION IN ALASKA: PRESENT AND FUTURE,
Federal Water Pollution Control Administration, College, Alaska, Water Lab.
Frederick B. Lotspeich.
Science, Vol 166, No 3910, p 1239-1245, Dec 1969. 7 p, 6 fig, 19 ref.

Descriptors: *Alaska, *Water pollution, *Ecology, *Permafrost, *Reviews, Surveys, Environment, Waste disposal, Climates, Fisheries, Water pollution sources.
Identifiers: Industrial development effects (Ecological).

Alaska is on the threshold of economic expansion. The magnitude of the expansion is unknown, but any expansion is certain to increase pollution pressures. Because Alaskan waters are, for the most part, still clean, a unique opportunity exists to apply a preventive program based on ecosystem dynamics, instead of the classical practice of cleanup after deterioration has set in. Research on the tundra and taiga ecosystems must be initiated to learn the dynamics of ecological response to man's quest for new resource development. Alaska's ecology, industry, present state of pollution, and the ecological effects of past industrial activity are briefly reviewed. The problems of the industrial use of permafrost areas are given special attention because of the North Slope oil development. (Knapp-USGS)
W70-01879

GENERALIZED DISTRIBUTION AND CONCENTRATION OF ORTHOPHOSPHATE IN FLORIDA STREAMS,
Geological Survey, Washington, D.C.
Matthew I. Kaufman.
Florida Dep Natur Resources, Bur Geol Map Ser No 33, Aug 1969. 1 sheet, text, 7 fig, 1 tab, 1 map, 9 ref.

Descriptors: *Water pollution sources, *Phosphates, *Florida, Industrial wastes, Municipal wastes, Farm wastes, Runoff, Leaching, Regional analysis, Fertilizers, Chemical wastes, Nutrients, Solutes, Streamflow, Distribution patterns, Mapping.
Identifiers: Orthophosphates.

The distribution and concentration of orthophosphate in Florida streams are described and shown by maps and graphs. In Florida, phosphate sources include industrial wastes, sewage effluent, agricultural drainage, urban drainage, runoff from land naturally rich in phosphates, and rainfall. The greatest contribution is manmade. (Knapp-USGS)
W70-01882

THE INFILTRATION OF ALDRIN THROUGH OTTAWA SAND COLUMNS,
Geological Survey, Idaho Falls, Idaho.
John B. Robertson, and Lloyd Kahn.
In: Geol Surv Res 1969, Prof Pap 650-C, p C219-C223, 1969. 5 p, 3 fig, 1 tab, 17 ref.

Descriptors: *Path of pollutants, *Aldrin, *Groundwater movement, Laboratory tests, Permeameters, Sands, Chlorinated hydrocarbon pesticides, Insecticides, Pesticide residues, Infiltration.
Identifiers: Ottawa sand, Aldrin infiltration.

The penetrability of chlorinated hydrocarbon insecticides through soils is dependent upon the type of formulation applied, frequency of its application, soil conditions, and the frequency and rate of rainfall or irrigation. Aldrin, a representative member of the chlorinated hydrocarbon insecticide group, was infiltrated through columns of Ottawa sand in four experiments. Most of the eluted aldrin in organic solvent systems was eluted during the passage of the first liter of water. The aldrin distributed itself in a characteristic manner through each column, depending upon the composition and stability of the emulsion and rate of water infiltration. The concentration of HHDN (active ingredient in aldrin) in the effluent from the columns reached a 'steady state' condition of 0.5 to 2 micrograms per liter of water. A commercial emulsible concentrate mixture transmitted more aldrin to the effluent than did a synthetic solution containing no emulsifier. (Knapp-USGS)
W70-01904

THERMAL POLLUTION AS A FACTOR IN POWER PLANT SITE SELECTION,
Rice (Cyrus Wm.) and Co., Pittsburgh, Pa.; and Gurnham, Bramer and Associates.
For primary bibliographic entry see Field 05A.
W70-01923

NITROGEN ENRICHMENT OF SURFACE WATER BY ABSORPTION OF AMMONIA VOLATILIZED FROM CATTLE FEEDLOTS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
G. L. Hutchinson, and F. G. Viets, Jr.
Science, Vol 166, No 3904, p 514-515, Oct 1969. 1 fig, 1 tab, 6 ref.

Descriptors: *Nitrogen, *Surface water, *Absorption, *Ammonia, Eutrophication, Water pollution sources, Nitrogen compounds, Nutrient cycling, Fertilization, Colorado, Precipitation (Atmospheric), Lakes, Streams.
Identifiers: *Nitrogen pollution, *Cattle feedlots, Seeley Lake (Colo), Nitrogen (Total), Nitrogen (Inorganic), Nitrogen enrichment.

A method is described for estimating nitrogen enrichment of surface waters resulting from volatilization of ammonia from cattle feedlots and its subsequent absorption into lakes and streams. Rates of ammonia absorption into dilute sulfuric acid (0.01 normal) measured near feedlots were as much as 20-fold greater than controls; estimated annual absorption (in kilograms/hectare) of 73 at site about 0.4 kilometers west of 90,000-unit feedlot can be compared with 3.9 at control site with no feedlots or irrigated fields within 3 milometers and no large feedlots or cities within 15 kilometers. Ammonia absorbed by surfaces of natural waters are apparently about half that estimated by method described. That a large feedlot can enhance nitrogen enrichment of aqueous surfaces at some distances is suggested by evidence that a fivefold increase in distance from a feedlot decreased mean ammonia absorption rate by approximately one-half. Absorption rates from smaller lots were approximately 25% of large one, but above fourfold greater than control. Authors believe that wide fluctuations in ammonia absorption rates reflect the moistness of feedlot surfaces, rapid drying enhancing volatilization and absorption. Authors conclude that such feedlots are substantial sources of nitrogen pollution for nearby surface waters. (Eichhorn-Wisconsin)
W70-01936

5C. Effects of Pollution

WATER QUALITY AND AGING OF STRIP-MINE LAKES,
Missouri Univ., Columbia. Dept. of Zoology; and Baylor Univ., Waco, Tex., Dept. of Biology.
Robert S. Campbell, and Owen T. Lind.
J Water Pollut Contr Federation, Vol 41, No 11, Part 1, p 1943-1955, Nov 1969. 13 p, 4 fig, 10 tab, 23 ref. FWPCA Res Grant No WP-00379 Fellowship Award No 2-FL-WP-22892.

Descriptors: *Strip mine lakes, *Acidic water, *Acid mine water, *Water quality, *Lake stages, Biodegradation, Chemical reactions, Water pollution effects, Sulfur bacteria.
Identifiers: Water quality changes.

In many strip-mine lakes the water is at first acidic, but with time becomes less acidic and finally alkaline. Two distinct successional stages are recognized--acid and alkaline--and are identified by different physical, chemical, and biological characteristics. Variation among lakes in the acid stage is dependent on the degree of acid pollution. (Knapp-USGS)
W70-01695

SLUDGE DISPOSAL AND THE MARINE ENVIRONMENT,
Municipality of Metropolitan Seattle, Wash.
For primary bibliographic entry see Field 05E.
W70-01764

THE BIOLOGICAL EFFECTS OF OIL POLLUTION ON LITTORAL COMMUNITIES. PROCEEDINGS OF A SYMPOSIUM, ORIELTON FIELD CENTRE, PEMBROKE, WALES, 17-19, February, 1968.

London, Field Studies Council, July, 1968. 198 p. Supplement to Vol 2 of Field Studies Council. Edited by J. D. Carthy and Don R. Arthur.

Descriptors: *Oil wastes, *Water pollution effects, *Water pollution sources, *Emulsifiers, *Detergents, *Ecology, *Environmental effects, Toxicity, Plant growth, Animal diseases, Microbiology, Bibliographies, Oily water, Ecosystems.
Identifiers: *Torrey Canyon, BP-1002, Durham coast, *Oil spillage.

The purpose was to assess the problems which are raised by oil pollution of a highly complex ecosystem. Oil, derived as it is by biological action, is a complex of substances whose chemistry is, even today, not fully known. The environment is similarly an interwoven web of factors, whose interactions, even under normal conditions, we are only just beginning to understand. When oil pollutes a balanced natural community, it brings a new unnatural factor to imbalance the environmental scene. Another complex variable is introduced when emulsifiers are used to clean away the oil. This symposium collects together the essential basic information, not only on oil but also on the background from which studies of the environmental effects can be initiated. (See also W70-01777 thru W70-01787).
W70-01776

EXTENT OF DAMAGE TO COASTAL HABITATS DUE TO THE TORREY CANYON INCIDENT,
Furzebrook Research Station, Wareham (England).
D. S. Ranwell.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July, 1968. p 39-47.

Descriptors: *Emulsifiers, *Mortality, *Marine algae, *Marsh plants, *Marine animals, *Oily water, Lichens, Tidal effects, Dispersion, Oil-water interfaces, Persistence, Water pollution treatment, Water pollution effects.
Identifiers: *Torrey Canyon, Susceptibility, Regeneration, Cliff vegetation, Sand dunes.

The full range of oil-contaminated habitats resulting from the Torrey Canyon spill were investigated from the air and ground. Decontamination measures and tidal action effectively cleared most oil from the Cornish coast, although some persisted throughout 1967. Over 1 1/2 million gallons of emulsifiers were used. They rapidly cleared the water surface but they distributed contamination beyond the original contamination area, both in depth in sand and water. Toxic elements in the emulsifiers destroyed some marine flora and fauna. The greatest damage occurred on the rocky shorelines where much oil was stranded. Inter-tidal algae and lichens suffered the most extensively among plants because of a cut-off of light and air. The most toxic fractions of crude oil are volatile and disappear rapidly. Manual removal of oil was much preferred over chemical removal methods, as it did not add to pollution. At least 100 species of algae, lichens, and flowering plants were filled by oil or emulsifier pollution. (See W70-01776). (Sjolseth-Washington)
W70-01777

PROBLEMS IN THE ASSESSMENT OF THE EFFECTS OF POLLUTION ON INSHORE MARINE ECOSYSTEMS DOMINATED BY ATTACHED MACROPHYTES,
Durham Univ. (England). Dept. of Geography.
David J. Bellamy, and Alan Whittick.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July, 1968. p 49-54.

Descriptors: *Phytometers, *Aquatic environment, Water pollution effects, Monitoring, Growth rates, Biological communities, Bioindicators.
Identifiers: *Durham Coast, *Phytosociological systems, *Macrophytic algae, Torrey Canyon, Kelp ecosystem performance, Site comparisons, Long-term pollution, Short-term pollution.

Methods have been developed in inshore marine ecosystems for the study of the effects of long-term pollution and these have been used to ascertain the effects of short-term pollution by reference to a study of the Torrey Canyon mishap. One method utilizes comparison with pre-pollution data. Another method is a contemporary comparison between nearby polluted and unpolluted sites. The data obtained by this method was used in two ways to obtain adequate comparison; (a) comparison of individual performance, and (b) comparison of ecosystem performance and potential. These methods have proved to be somewhat successful, although more data will have to be collected to distinguish pollution effects from variations due to natural environmental conditions. (See W70-01776). (Sjolseth-Washington)
W70-01778

EXPERIMENTS WITH SOME DETERGENTS AND CERTAIN INTERTIDAL ALGAE,
University Coll. of Wales, Aberystwyth. Dept. of Botany.
A. D. Boney.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July, 1968. p 55-72.

Descriptors: *Detergents, *Marine algae, Water pollution effects, Lethal limit, Growth rates, Spores.
Identifiers: *Torrey Canyon, *Detergent concentrations, Survival, Susceptibility, Physiological observations, Chronic exposure, Acute exposure.

The direct effects of detergent application following the Torrey Canyon disaster on seven test species of marine algae were studied. Six detergents were used each at several different concentrations. The receptacle tissues of Ascophyllum nodosum were damaged. Cell damage was extensive in Cladophora rupestris. Bryopsis hypnoides were easily killed. The cept phases of Prasinocladus marinus were destroyed by detergents. Growth and spore production of Acrohaetium infestans were retarded. No immediate cell damage was noticed among Polysiphonia lanosa and Porphyra umbilicalis. Both acute and chronic exposures were utilized. (See W70-01776). (Sjolseth-Washington)
W70-01779

BIOLOGICAL CONSEQUENCES OF OIL POLLUTION AND SHORE CLEANSING,
University Coll. of Swansea (Wales). Dept. of Zoology.
A. Nelson-Smith.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July, 1968. p 73-80.

Descriptors: *Oily water, *Marine algae, *Emulsifiers, Water pollution effects, Mortality, Gastropods, Marine plants, On-site data collections.
Identifiers: *Torrey Canyon, Repopulation, Susceptibility.

The effects of oil spills in different areas were investigated to provide interesting comparisons. Oil spilled into a small cove yielded extensive shore pollution and mortalities. No emulsifiers were used, and in less than a year the animal populations were again normal. Gastropod molluscs appeared to be most seriously affected. Marine algae populations were also reduced. Misuse of emulsifiers embedded the oil more firmly and resulted in increased mortalities. Emulsifiers enable the oil to wet the surfaces of shore organisms and to penetrate their systems and also to spread the oil to previously unreached areas. Time of year of oil spill and mobility of organisms regulate the rate at which the members of the shore community are able to recover from oil pollution. (See W70-01776). (Sjolseth-Washington)
W70-01780

THE TOXICITY OF OIL EMULSIFIERS TO SOME INSHORE FAUNA,
University of Strathclyde, Glasgow, (Scotland). Dept. of Biology.
E. J. Perkins.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July, 1968. p 81-90.

Descriptors: *Emulsifiers, *Lethal limit, *Bioassay, Marine animals, Water pollution effects, Hydrogen-ion concentration.
Identifiers: *Torrey Canyon, BP 1002, Long-term effects, Short-term effects, Recovery, Dose, Inshore fauna.

Determinations of the acute toxicity of several emulsifiers (BP 1002, Basic 'Slickgone' and Petrofina Tarsolvent) were made and based upon the 24-hour TLm. Oil emulsifiers were found to be very toxic to marine animals. BP 1002 was the most toxic emulsifier. The toxicity of the emulsifiers was related to their stability. The more stable, the more toxic. It was pointed out that effects at dose levels much below the median tolerance limits are likely to be significant in the long run. All emulsifiers tested depressed the pH of seawater. Emulsifiers may produce 100 per cent mortality in 96 hours, at concentrations as low as 10 ppm. The TLm was noticed to vary from season to season. (See W70-01776). (Sjolseth-Washington)
W70-01781

OIL, EMULSIFIERS AND COMMERCIAL SHELLFISH,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
A. C. Simpson.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July 1968. p 91-98.

Descriptors: *Emulsifiers, *Crustaceans, *Mollusks, Oily water, Water pollution effects, Taste, Lethal limit.
Identifiers: BP 1002, Relative susceptibilities, Life stage.

There is no evidence that shellfish have ever been killed by oil spilled, although economic loss is realized because the oil makes them unpalatable. Tested the harm that solvent/emulsifiers might do to shellfish if applied directly on the grounds and determined the toxicity of the solvent/emulsifiers in sea water. Found that if the emulsifiers were applied to areas containing shellfish, a proportion would be killed. These chemicals (diluted in the sea) were also toxic to marine animals. The toxicity of BP 1002 was found to decrease rapidly with time, due primarily to evaporation of the solvent. Experiments were undertaken to determine the relative toxicities to mulluscs and crustaceans of 9 solvent/emulsifiers. The young stages of animals were more susceptible to toxic subtances than were adults. Emulsifiers were found to taint the flesh of shellfish, making them unsaleable. (See W70-01776). (Sjolseth-Washington)
W70-01782

OIL POLLUTION AND BIRD POPULATIONS,
Seabird Group.
W. R. P. Bourne.
Biological Effects of Oil Pollution on Littoral Communities, Supplement to Volume 2 of Field Studies. London, Field Studies Council, July 1968. p 99-121.

Descriptors: *Water birds, *Oily water, Rehabilitation, Fecundity, Water pollution effects, Migratory birds, Migration patterns, Data collections, Mortality.
Identifiers: *Torrey Canyon, Adaptations.

Aquatic birds are particularly susceptible to oil pollution. Since their reproductive capacity is low, the results are devastating. An historical survey of the work conducted on oil pollution and birds is presented. The effect of past oil spills on bird populations is described in detail. Declines of certain bird populations are related to oil pollutions. The composition of the bird-kill in some British oil pollution incidents (e.g., Torrey Canyon) was presented. The main mortality occurs among the young birds. Extreme adaptation to an aquatic environment renders birds susceptible to oil pollution because they are not capable of sustained flight and must often touch the water surface where they are continually exposed to floating oil. Aquatic seabirds have no defenses against oil. Rehabilitation of oil contaminated birds is not very successful. Possible future research is discussed. (See W70-01776). (Sjolseth-Washington)
W70-01783

POST-MORTEM FINDINGS IN OILED AUKS DYING DURING ATTEMPTED REHABILITATION,
Wildfowl Trust, Slimbridge (England).
J. V. Beer.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July 1968. p 123-129.

Descriptors: *Oily water, *Rehabilitation, *Water birds, Water pollution effects, Mortality, Stress, Parasitism, Diseases.
Identifiers: *Post-mortem examination, Torrey Canyon, Auks, Starvation.

Birds suffering from oil pollution occuring after the Torrey Canyon affair were captured and given rehabilitation. The survival of auks during attempted rehabilitation was determined to be low. Mortality during attempted rehabilitation followed an exponential path. Only a small proportion of birds were rehabilitated. The dead birds were given post-mortem examinations. Practically all of the birds which died were emaciated. Respiratory disease, acute enteric conditions, renal diseases, and oil stained plumage were among the most serious conditions. The pattern of mortality and pathological changes were strongly suggestive of severe stress and the presence of powerful irritants of poisons in the gut. (See W70-01776). (Sjolseth-Washington)
W70-01784

EFFECT OF DETERGENTS AND OILS ON THE CELL MEMBRANE,
Chester Beatty Research Inst., London (England).
R. J. Goldacre.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July 1968. p 131-137.

Descriptors: *Emulsifiers, *Biological membranes, *Detergents, Effects of water pollution, Solubility, Chemical properties.
Identifiers: *Paraffin hydrocarbons, *Amoeba proteus, BP 1002, Anionic detergents, Cationic detergents, Non-ionized detergents, Volatility, Narcotic effects.

This paper reports on the effects of various pure substances found in crude oil and in emulsifiers on the plasma membrane of Amoeba proteus. With increasing oil concentrations the Amoeba became anaesthetized, the plasma membrane doubled in area, and the inner surface of the cell membrane peeled off. If the cells were kept in the oil, they died, often accompanied by bursting of the plasma membrane. Paraffin hydrocarbons above C14 were not able to damage the membrane. Involatile and relatively insoluble oils had no effect on Amoeba even in saturated solution. Anionic detergents cause rapid removal of the cell membrane, resulting in bursting of the cell. Cationic detergent caused a toughening of the cell membrane and eventually death. Non-ionized detergents such as BP 1002 used in the Torrey Canyon disaster also left a visible membrane after killing the cells. Author feels that the mechanism with detergents may therefore be adsorption on the membrane of competition for adsorption with an existing membrane component. (See W70-01776). (Sjolseth-Washington)
W70-01785

THE BIOLOGICAL PROBLEMS OF LITTORAL POLLUTION BY OIL AND EMULSIFIERS -- A SUMMING UP,
King's Coll., London (England). Dept. of Zoology.
Don R. Arthur.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July 1968. p 159-164.

Descriptors: *Oily water, *Marine animals, *Mortality, Water pollution treatment, Water pollution effects, Marine plants, Emulsifiers, Detergents, Aquatic environment, Biological communities, Mollusks, Crustaceans, Rehabilitation.
Identifiers: Torrey Canyon, Regeneration, Recovery.

The author reviews the biological problems of Littoral pollution by oil and emulsifiers discussed in the symposium of which this paper is a part. The magnitude of oil pollution and prospects for increased pollution are described. The dangers of pollution are elaborated. The primary causes of death by pollution are reviewed. The need for determining the chronic effects of oil pollution is stated. Nine problems which urgently need the attention of biologists are elaborated. (See W70-01776). (Sjolseth-Washington)
W70-01786

A CLASSIFIED BIBLIOGRAPHY OF OIL POLLUTION,
University Coll. of Swansea (Wales). Dept. of Zoology.
A. Nelson-Smith.
Biological Effects of Oil Pollution on Littoral Communities. Supplement to Volume 2 of Field Studies. London, Field Studies Council, July 1968. p 165-196.

Descriptors: *Water pollution sources, *Bibliographies, *Water pollution effects, *Water pollution treatment, Emulsifiers, Rehabilitation, Mortality, Water birds, Fish, Fishkill, Chemical properties, Physical properties.

This article contains a classified bibliography of oil pollution. The bibliography contains 6 subgroups: (1) General accounts and overall effects of oil pollution incidents. 193 entries; (2) More specific accounts of biological effects of oil pollution. 169 entries; (3) Processes and methods by which split oil is removed. 219 entries; (4) Sources, control and prevention of oil pollution. 157 entries; (5) Physical and chemical properties of hydro carbons influencing their behavior as pollutants. 33 entries; (6) Methods for detection, identification and determination. 68 entries. (See W70-01776). (Sjolseth-Washington)
W70-01787

PHYSIOLOGY OF GRANULAR LEUKOCYTES IN FISH BLOOD,
L. I. Smirnova.
Translation from Voprosy Ikhtiologii. Problems of Ichthyology, Vol 8, No 5, 1968. p 748-755.

Descriptors: *Fish physiology, *Algae, *Thermal pollution, *Toxicity.
Identifiers: *Fish hematology, *Granular leucocytes, *Muscular exertion, *2-methyl-5-vinylpyridine, *Glue green algae, Bream, White bream, Leukocytic composition, Alternating current.

A connection was established between the leucocytic composition of the blood in fed and starving bream. An increase in the number of granulocytes circulating in the blood was observed in some favorable and some stress conditions, such as intensive feeding, temperature increase, increased activity, electrical stimulation and exposure to 2-methyl-5-vinylpyridine, Blue green algae. With the changes in the white blood cell composition, there were parallel reductions in the resistance of red cells and their subsequent destruction. (Katz-Washington)
W70-01788

MORTALITY RATE OF DREISSENA IN ANAEROBIC CONDITIONS,
V. P. Mikheev.

Trans from Trudy Instituta Biologii Vnutrennikh Vod, No 7 (10), 1964. Jerusalem, Israel Program for Scientific Translations, 1968, p 65-68.

Descriptors: *Mollusks, *Oxygen sag, *Anaerobic conditions, *Mortality, Water pollution.
Identifiers: *Dreissena, *Oxygen deficient waters, *Water temperature effects, *Oxygen requirements.

Reported an experiment to determine ability of Dreissena to tolerate reduced oxygen conditions. Dreissena were able to survive in water with D.O less the 0.7 mg/l for several days and some survived for two days in anaerobic water. Survival in the water of reduced D.O was less at higher temperatures. Small mollusks have greater relative oxygen consumption and die sooner than the larger organisms. (Katz-Washington)
W70-01789

EFFECTS OF COBALT CHLORIDE ON PHYSIOLOGICAL INDICES IN RAINBOW TROUT (SALMO IRIDEUS GIBBONS),
Gosudarstvennyi Nauchno-Issledovatelskii Institut Ozernogo i Rechnogo Rybnogo Khozyaistva, Leningrad (USSR).
A. A. Shabalina.
Translation from Voprosy Ikhtiologii, Problems of Ichthyology, Vol 8, No 5, 1968, p 741-747.

Descriptors: *Rainbow trout, *Cobalt, *Toxicity, Water pollution effects, Water temperature.
Identifiers: *Cobalt chloride, *Body fat distribution, Hemoglobin content, Hematological indices, Heat tolerance.

Cobalt chloride was added to the diet of young and two-year old rainbow trout. The tolerance of the young trout to increased water temperatures was not affected, but the tolerance of the two-year olds was increased by 1.6 deg C. Hemoglobin content of the blood was unchanged. The distribution of body fat was changed. In toxic doses cobalt produced gastro-intestinal hemorrhages in both groups of fish. (Katz-Washington)
W70-01790

EFFECTS OF FOREST SPRAYING WITH DDT IN NEW BRUNSWICK ON FOOD OF YOUNG ATLANTIC SALMON,
University of Western Ontario, London. Dept. of Zoology.
Miles H. A. Keenleyside.
Journal of Fisheries Research Board of Canada, 24 (4), 1967, 807-822. 6 fig, 4 tab, 20 ref.

Descriptors: *Atlantic salmon, *DDT, *Fish diets, *Aquatic insects, Spraying, Feeding rates, Forage mixtures, Diptera.
Identifiers: *Stomach contents, Ephemeroptera, Trichoptera, Chironomidae.

Food in stomachs of your Atlantic salmon from the Northwest Miramichi River, N.B., changed following aerial DDT spraying of the surrounding watershed. Before spraying, young salmon typically ate immature aquatic insects, fry (underyearlings) concentrating on Diptera and small Ephemeroptera, and parr (overyearlings) on Diptera, Trichoptera, and all sizes of Ephemeroptera. Reduction of all aquatic insects by DDT was soon followed by resurgence of Chironomidae and other Diptera, and surviving fry fed heavily on these; parr fed on Diptera but also ate snails, worms, and fish, previously unimportant in their diet. Five years after the last spraying the prespray complexity of young salmon food was being approached. Trichoptera were slowest of the major fish-food types to reappear in stomachs. In fry stomachs Ephemeroptera, and in parr stomachs Ephemeroptera and trichoptera, were relatively more abundant than in the surrounding stream fauna. Greater availability of these insects and active selection by fish are discussed as possible causes of these relationships. (Sjolseth-Washington)
W70-01793

PHYSIOLOGICAL TOLERANCES AND BEHAVIOR RESPONSES OF FIVE SPECIES OF HAUSTORIIDAE (AMPHIPODA: CRUSTACEA) TO FIVE ENVIRONMENTAL FACTORS,
Fisheries Research Board of Canada. Marine Ecology Lab.; and Bedford Inst., Dartmouth (Nova Scotia).
D. D. Sameoto.
Journal of Fisheries Research Board of Canada, Vol 26, No 9, 1969, p 2283-2298. 3 fig, 3 tab, 32 ref.

Descriptors: *Amphipoda, *Crustaceans, *Organic matter, *Oxygen requirements, *Particle size, *Salinity, *Temperature, Sediments.
Identifiers: *Desiccation, *Gaustoriidae, Cape Cod.

Five species of haustoriid amphipods from Cape Cod, Massachusetts, differed in their tolerances to high temperature, desiccation, low salinity, and low oxygen concentration and in references for different sediment sizes. Two intertidal species, Haustorius canadensis Bousfield and Neohaustorius biarticulatus Bousfield, survived longer in air at 100% relative humidity and were more resistant to high water temperature than three species that are basically subtidal, Acanthohaustorius millsi Boudfield, Parahaustorius longimerus Boudfield, and Protohaustorius deichmannae Boudfield. All five species preferred sediments of a particular size range, the intertidal species selecting coarser sediments than the subtidal species. The sediment preference shown by the intertidal species could be changed by altering the organic conditions of the sediment by either drying or igniting the sediment. Acanthohaustorius millsi was the species most tolerant to low oxygen concentration and H. canadensis had the lowest oxygen consumption rate of the five species. The ecological significance of these findings is discussed in relation to the distribution of the five species on Cape Cod. (Tyner-Washington)
W70-01794

INFLUENCE OF TEMPERATURE ON GAFFKEMIA, A BACTERIAL DISEASE OF THE LOBSTER HOMARUS AMERICANUS,
Fisheries Research Board of Canada, Halifax (Nova Scotia). Halifax Lab.
James E. Stewart, John W. Cornick, and B. M. Zwicker.
Journal of Fisheries Research Board of Canada, Vol 26, No 9, 1969, p 2503-2510. 4 fig, 2 tab, 9 ref.

Descriptors: *Temperature, *Lobsters, *Infection, *Pathogenic bacteria, Bacteria, Sea water.
Identifiers: *Gaffkemia, Mean time to death, Nova Scotia, Homarus americanus, Gaffkya homari.

The mean time to death for lobsters (Homarus americanus) infected with Gaffkya homari and kept at constant temperatures was 2 days at 20 C, 12 days at 15 C, 28 days at 10 C, 65 days at 7 C, 84 days at 5 C, and 172 days at 3 C. The lobsters were unable to mobilize at any of these temperatures systemic defenses adequate to eliminate the pathogen. No deaths that could be attributed to infection with G. homari occurred during the 250-day trial at 1 C; the pathogen, however, was not eliminated at this temperature but remained in the lobsters at low levels with virulence unchanged and gave rise to a fatal infection when the temperature was increased. Further studies showed that infected lobsters were adversely affected by a relatively rapid increase of 10 degrees C but not by a 5-degree C increase; a relatively rapid decrease of 15 degrees C but not 10 degrees C was adverse. Infected lobsters at 15 C were most sensitive to a 5-degree C decrease around the 12th day of the infection. (Tyner-Washington)
W70-01795

STUDIES ON EFFECTS OF FOREST SPRAYING WITH INSECTICIDES, 1952-63, ON FISH AND AQUATIC INVERTEBRATES IN NEW BRUNSWICK STREAMS: INTRODUCTION AND SUMMARY,
Fisheries Research Board of Canada, St. Andrew (New Brunswick). Biological Station.
C. J. Kerswill.
Journal of Fisheries Research Board of Canada, 24 (4), 1967, p 701-708. 1 fig, 1 tab, 23 ref.

Descriptors: *Spraying, *Insecticides, *DDT, *Aquatic insects, Effects of water pollution, Atlantic salmon, Brook trout, Fish populations, Mortality.
Identifiers: Aquatic invertebrates, Choristoneura fumiferana, Stomach contents.

This introduces a series of papers on fisheries studies associated with operational and experimental forest spraying, mainly with DDT-in-oil insecticide. It outlines: (a) the history of the spray program developed to counteract an outbreak of the spruce budworm (Choristoneura fumiferana) in New Brunswick; (b) administrative arrangements for developing and coordinating a reasonable research and management program concerning the affected fisheries, mainly for Atlantic salmon (Salmo salar); (c) highlights of field and laboratory studies on effects of insecticide sprayings on caged young salmon and trout (Salvelinus fontinalis), on aquatic insect production, on feeding habits of native young salmon, and on population levels of young salmon. (Sjolseth-Washington)
W70-01796

TREATMENT OF SHELL WITH POLYSTREAM TO INCREASE SURVIVAL OF OYSTERS (CRASSOSTREA VIRGINICA) IN VIRGINIA,
Virginia Inst. of Marine Science, Gloucester Point.
Dexter S. Haven, and James P. Whitcomb.
Special Scientific Report No 54, Mar 1969. 6 p, 2 tab, 5 ref.

Descriptors: *Oysters, *Predation, *Virginia, Mollusks, Molluscacides, Pesticides, Snails.
Identifiers: *Drills, *Plystream, Crassostrea virginica, Oyster spat, Urosalpinx cinerea.

Survival of oysters set on shells treated with Polystream was investigated during 1963 and 1964. Treated and control shells were held in wire bags in the high-salinity intertidal seaside area of the Eastern Shore and in the moderate-salinity subtidal areas of the lower James River. Significantly more spat survived on treated shells than on controls. Differences in survival could not be attributed to absence of drill predation on treated shall. (Tyner-Washington)
W70-01797

THE EFFECTS OF pH, TEMPERATURE AND ACTINOMYCIN ON THE SULFHYDRYL GROUPS IN LIVING EMBRYOS OF SEA URCHINS (FRENCH),
McGill Univ., Montreal (Quebec). Dept. of Zoology.
N. Wolfson.
Comptes rendus des seances de la Societe de Biologie, Vol 162, No 1, 1968, p 73-76. 3 tab, 5 ref.

Descriptors: *Embryonic growth stage, *Proteins, *Temperature, Acidity, Alkalinity.
Identifiers: *Actinomycin, *Mercurial, *pH, *Sea urchins, *Sulfhydryl groups, Blastula, Gastrula, Embryo, Paracentrotus lividus.

The amount of organic mercurial which living embryos of sea urchins can bind shows a gradual increase during early development, an increase which is interpreted as a rise in the superficial sulfhydryl groups accessible to the mercurials. Variations of pH and of temperature produce changes in the SH assay which are compatible with the expected influence of these factors on the availability of SH. Embryos blocked in blastula stage by actinomycin show very little decrease in amount of mercurial bound as compared to gastrular controls, indicating that new gastrular proteins contribute little to binding of mercurials. (Tyner-Washington)
W70-01798

WATER POLLUTION IN ALASKA: PRESENT AND FUTURE,
Federal Water Pollution Control Administration, College, Alaska, Water Lab.
For primary bibliographic entry see Field 05B.
W70-01879

THE SURVIVAL OF SALMON (SALMO SALAR L.) AND SEA TROUT (S. TRUTTA L.) IN FRESH AND SALINE WATER AT HIGH TEMPERATURES,
Ministry of Agriculture, Fisheries and Food, London (England).
J. S. Alabaster.
Water Research, Vol 1, p 717-730, Oct 1967. 6 fig, 6 tab, 17 ref.

Descriptors: *Temperature, *Thermal pollution, *Smolt, *Acclimatization, Salmon, Trout, Salinity, Fisheries.
Identifiers: Salmon parr, Trout parr, Ionic balance, Scotland.

The survival of salmon and seatrout smolts, on sudden exposure to increased temperature, has been measured under field and laboratory conditions in both fresh and salt water. Smolts are more sensitive than parr when tested in fresh water, particularly if no special care is taken to acclimate the fish to the test conditions beforehand. Salmon smolts are most sensitive to an increase in temperature when exposed simultaneously to change from fresh to sea water, though the effect is much less even after only 7 hours prior acclimation to sea water; they are most resistant when tested in 30 per cent sea water. The results indicate that, at the beginning of the period of smolt migration, when acclimation temperatures are about 8 deg C, the rise in temperature of cooling water used by power stations (6-9 deg C) is smaller than any change that could kill fish. At the height of the smolt season, with acclimation temperatures of 10-12 deg C, only abnormal increase in temperature such as might be the case with recirculating back to the cooling water intake, if accompanied by a change from fresh to sea water, without prior acclimation will be lethal. (Rietveld-Vanderbilt)
W70-01913

PHYSIOLOGY OF ACCLIMATION TO LOW TEMPERATURE IN POIKILOTHERMS,
Sri Venkateswara Univ., Tirupati (India). Dept. of Zoology.
Kandula Pampapathi Rao.
Science, Vol 137, p 682-3, Aug 1962. 1 tab, 9 ref, 2 p.

Descriptors: *Acclimatization, *Cold resistance, Temperature, Mussels, Worms.

The freshwater mussel, Lamellidens marginalis, and the earthworm, Lampito mauritii, were acclimated to temperatures of 29 deg plus or minus 1 deg C and 19 deg C plus or minus 1 deg C for 20 to 30 days. Analysis of blood of mussels drawn from the heart and body fluids from the earthworm revealed an increase in sodium, potassium, and calcium during cold acclimation in both species. Chloride, magnesium, and free amino acids decreased in both species. Increased protein synthesis occurred in both species and neurosecretory cells of the cold acclimated earthworms exhibited increased activity. Addition of cold acclimated worm body fluid stimulated oxygen consumption in tissues of warm acclimated specimens, indicating that a hormonal agent triggers the sequence of biochemical changes. (Speakman-Vanderbilt)
W70-01916

BENEFICIAL USES OF THERMAL DISCHARGE,
New York State Dept. of Commerce, Albany; and State Univ. of New York, Albany. Atmospheric Sciences Research Center.
R. Stewart, and S. Bjornsson.
Summary Report of the Adirondack Conference, Oct 14-17, 1969. 12 p, 2 fig.

Descriptors: Temperature, *Thermal pollution, *Freeze-drying, Cooling towers.
Identifiers: *Space heating.

This article is the summary of the Adirondack conference and deals with present and future uses of hot water and low grade steam. In Iceland geothermal discharges are being used for space heating, processing, industry, swimming pools and other sporting facilities. The Icelandic fish culture designed to raise salmonoids to release-size in eight months instead of the normal growth period of two years, uses the geothermal discharge to maintain the proper temperature range (10-12C). Of greater economic significance is the use of the steam for freeze-drying. A freeze-dried product weighs about 10-30% of its original weight and may be stored for years. To freeze 1 Kg/fish takes 10.5 Kwh so discharge from 1000 Mw plant contains sufficient heat to freeze-dry 200 tons of fish per hour. A 1000 Mw reactor could heat a 500 acre green house farm (effectively horizontal cooling towers) producing $12 million/year in crops. (Upadhyaya-Vanderbilt)
W70-01922

THERMAL REINFORCEMENT AND THERMOREGULATORY BEHAVIOR IN THE GOLDFISH, CARASSIUS AURATUS,
Harvard Univ., Cambridge. Psychological Labs.; and Harvard School of Public Health, Boston, Mass.
Paul N. Rozin, and Jean Mayer.
Science, Vol 134, Sept 1961. 2 p, 2 fig, 5 ref.

Descriptors: *Temperature control, *Training, Fish.
Identifiers: *Goldfish.

This work shows that goldfish can be trained to perform an arbitrary response in order to bring the environmental temperature closer to its preferred temperature, and if they are given an opportunity, they will control their body temperature to a certain extent. Each of seven goldfish was trained to press a lever with its head in order to produce a drop of approximately 0.3 deg C in the environmental temperature. Two procedures were followed in the experimental sessions. In the first the lever was not accessible until the temperature was raised to 38 deg C, just 3 deg C below the lethal temperature. In the second procedure the temperature was raised gradually from the acclimatization value of 23.5 deg C, and the lever was available throughout the test. Under both procedures the fish controlled the temperature at a level between 33.5 and 36.5 deg C, indicating that the goldfish will regulate its body temperature under constant high-temperature stress. (Speakman-Vanderbilt)
W70-01925

DETERMINATION OF THE BIOMASS OF AQUATIC PLANTS USING AN OPTICAL METHOD,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 07B.
W70-01931

AN INVESTIGATION BY RAPID CARBON-14 BIOASSAY OF FACTORS AFFECTING THE CULTURAL EUTROPHICATION OF LAKE TAHOE, CALIFORNIA-NEVADA,
California Univ., Davis. Dept of Zoology; and Engineering-Science Inc., Oakland, Calif.
Charles R. Goldman, and Ralf C. Carter.
Journal Water Pollution Control Federation, Vol 37, No 7, p 1044-1059, 1965. 11 fig, 5 tab, 27 ref.

Descriptors: *Lakes, *Carbon radioisotopes, *Bioassay, *Eutrophication, *California, *Nevada, Limnology, Primary productivity, Chlorophyll, Sampling, Phytoplankton, Radioactivity, Photosynthesis, Chemical analysis, Trace elements, Temperature, Iron, Nutrients, Light penetration, Sewage effluents, Oxygen, Solar radiation, Periphyton, Bacteria, Spectroscopy, Copper, Nitrogen, Phosphorus, Algae, Water pollution effects, Water chemistry.
Identifiers: *Lake Tahoe (Calif-Nev), Transparency, Light measurements, Euphotic zone, Plant carotenoids, Carbon fixation, Pelagic region, Monomictic, Depth effects, Ionic concentration, Seasonal effects.

Attempts were made to determine significant variability in the present fertility of Lake Tahoe, to estimate more precisely the lake's productivity by a more comprehensive sampling program than previously possible, and, with carbon-14 bioassay methods, to determine eutrophication potential of inflow, both natural and that enriched with sewage effluent. The extreme sensitivity of the carbon-14 method provides a means of predicting levels of nutrient addition which might cause objectional eutrophication. Assumption that the physiological condition of plankton is variable in different parts of the lake is supported by results of study. Areal estimates of productivity were determined by integrating photosynthetic curves resulting from consideration of light extinction, variation in temperature, and the distribution of plankton with depth. A secondary sewage effluent, when diluted to 1/3,700 of original strength, stimulates bioactivity in Lake Tahoe sufficiently to produce a 1% decrease in light transmittance within 12 days. Measurements of primary productivity around the lake's margin show that, despite extensive mixing, localized signs of eutrophication are evident. The extreme sensitivity of Lake Tahoe waters to any change in nutrient regime clearly evidences the potential of even treated effluent for speeding eutrophication. (Jones-Wisconsin)
W70-01933

TDE RESIDUES IN CLEAR LAKE ANIMALS,
California State Dept. of Fish and Game, Sacramento. Wildlife Management Branch; and California State Dept. of Public Health, Sacramento. Food and Drug Lab.
Jack D. Linn, and Ronald L. Stanley.
California Fish and Game, Vol 55, No 3, p 164-178, 1969. 1 fig, 13 tab, 5 ref.

Descriptors: *Chlorinated hydrocarbon pesticide, *Pesticide residues, Bass, Bullheads, Gulls, California, Catfishes, Plankton, Sunfishes, Gas chromatography, Water pollution sources, Water pollution effects.
Identifiers: *DDD, *TDE, Black crappie, Goldeneye, Grebe, Merganser, Sacramento perch, Clear Lake (Calif), Tetrachloro-diphenyl-ethane, Dichloro-diphenyl-dichlorethane.

Thirteen collections taken from Clear Lake, California, between 1959 and 1965, comprising eight fish species, four bird species and one plankton sample, were analyzed for TDE (DDD) residues. Colorimetric method (before 1962) and electron capture gas chromatography were used to determine concentrations of pesticide. No well-defined year-to-year trend in residue levels was noted when all samples were examined together. White catfish showed some tendency toward increased residue levels with increasing age, while mean annual TDE residue in largemouth bass (1958 year class) decreased from 23.5 parts/million (ppm) in 1958 to 7 ppm in 1963. Evidence indicates that TDE contamination, originating from three applications for insect control in 1949, 1954 and 1957, is declining. Mean annual levels in white catfish have declined from 85.7 ppm (1958) to 9.6 ppm (1965) and levels in largemouth bass have declined from 40.9 ppm (1958) to 12.2 ppm (1963). Tabular data include results of flesh and fat analyses for all collections and a comparison of data derived by colorimetric and gas chromatographic methods. (Voigtlander-Wisconsin)
W70-01935

NITROGEN ENRICHMENT OF SURFACE WATER BY ABSORPTION OF AMMONIA VOLATILIZED FROM CATTLE FEEDLOTS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05B.
W70-01936

AQUATIC WEED CONTROL WITH SODIUM ARSENITE,
Wisconsin State Board of Health, Madison. Committee on Water Pollution.
For primary bibliographic entry see Field 05G.
W70-01939

PROCEEDINGS OF THE CONFERENCE ON CHANGES IN THE BIOTA OF LAKES ERIE AND ONTARIO.
Buffalo Society of Natural Sciences, N.Y.; and State Univ. of New York, Buffalo. Research Foundation.

Bulletin of the Buffalo Society of Natural Sciences, Vol 25, No 1, 1969. 84 p, 19 fig, 2 tab, 141 ref. Sweeney, Robert A (Editor).

Descriptors: *Conferences, *Biota, *Lake Erie, *Lake Ontario, Analytical techniques, New York, Ecology, Great Lakes, Planning, Eutrophication, Plankton, Water pollution effects, Commercial fish, Fish, Lakes, Plants, Benthos.
Identifiers: Buffalo Society of Natural Sciences, State University College at Buffalo, Buffalo (NY), Lower Great Lakes, Game fish, Ecological techniques.

Growing public concern exists regarding changes effected by pollution and cultural eutrophication on the biota of Lakes Erie and Ontario, particularly regarding the decline of commercial and game fishes, the marked increase of less desirable species, and the alteration in quality and quantity of the flora. This publication reports the proceedings of a conference, held on April 16-17, 1968, of a small group of investigators interested in current or planned studies of these lakes. The conference was organized by the Biology Department, State University College at Buffalo and the Buffalo Society of Natural Sciences and supported by the Research Foundation of the State University of New York. Individual contributions, with names of author indicated in parentheses, are: Changes in the biology of the Lower Great Lakes (Charles A Dambach); Plants in Lakes Erie and Ontario, and changes of their numbers and kinds (Charles C Davis); and Changes in the benthos of Lakes Erie and Ontario (Ralph O Brinkhurst). Report includes an introduction, transcription of discussions following individual papers, and a transcription of a discussion by all participants of problems and techniques. (See also W70-01943 thru W70-01945). (Eichhorn-Wisconsin)
W70-01942

CHANGES IN THE BIOLOGY OF THE LOWER GREAT LAKES,
Ohio State Univ., Columbus. Natural Resources Inst.
Charles A. Dambach.
Bulletin of the Buffalo Society of Natural Sciences, Vol 25, No 1, p 1-17, 1969. 19 ref.

Descriptors: *Biology, *Great Lakes, *Lake Erie, *Lake Michigan, *Lake Ontario, Lake Huron, Aesthetics, Ecology, Economics, Ohio, Commercial fishing, Public health, Walleye, Vegetation, Wild rice, Silts, Plankton, Mayflies, Fauna, Fish, Oligochaetes, Midges, Snails, Phosphorus, Nutrients, Algae, Diatoms, Chlorophyta, Dissolved oxygen, Pike, Carp, Drum (Freshwater), Cisco, Lake trout, Eutrophication, Striped bass, Cyanophyta, Water pollution effects, Electric powerplants.
Identifiers: Hexagenia, Chironomidae, Procladius, Chironomus promosus, Trichoptera, Leeches, Fingernail clams, White fish, Alewife, Gizzard shad, Sea lamphrey, Coho salmon.

Dramatic biological changes have appeared in bottom fauna and among certain fishes of the lower Great Lakes. Of special significance is abundant increase, since 1959, of the midge Procladius, a supposedly more pollution-tolerant form, while Chironomus promosus has decreased, suggesting that pollution zones have extended further into the lakes. The mayfly is now rare. Benthic fauna is now dominated by oligochaetes and midges, with some fingernail clams, snails, and leeches on the increase. Chemical conditions probably provide a more reliable index to changes than plankton data, but are difficult to relate. Species composition, once dominated by diatoms, are now dominated by blue-green algae. Decline of certain high quality fishes, notably the blue pike and walleye pike, is largely responsible for the accelerated public interest in corrective measures. Relative significance of environment versus overfishing is debatable. Increase in eutrophication rate of the Great Lakes, especially Lake Erie, is significant. Human technology can so modify the environment that biological populations are significantly affected. Biologists with requisite knowledge, should develop better guidelines for weighing costs of each increment of degradation and each increment of improvement. (See W70-01942). (Jones-Wisconsin)
W70-01943

PLANTS IN LAKES ERIE AND ONTARIO, AND CHANGES OF THEIR NUMBERS AND KINDS,
Memorial Univ. of Newfoundland, St. Johns. Dept. of Biology.
Charles C. Davis.
Bulletin of the Buffalo Society of Natural Sciences, Vol 25, No 1, p 18-44, 1969. 8 fig, 2 tab, 100 ref.

Descriptors: *Lake Erie, *Lake Ontario, *Plants, Phytoplankton, Benthic fauna, Benthic flora, Diatoms, Nannoplankton, Ecology, Climates, Weather modification, Depth, Eutrophication, Glaciation, Water levels, Storms, Seiches, Solar radiation, Rainfall, Runoff, Winds, Carp, Muskrats, Turbidity, Cyanophyta, Chlorophyta, Ecosystems, Molds, Management, Periphyton, Yeasts, Fish, Water pollution effects.
Identifiers: Upwarping, Cladophora fracta, Asterionella, Synedra, Melosira, Cyclotella, Fragilaria, Stephanodiscus, Pediastrum, Anabaena, Oscillatoria, Seasonal pulses, Tectonic changes, Phycomycetes, Phytogeography.

The literature regarding vegetational changes in Lakes Erie and Ontario is reviewed. Most studies dealing with periphyton have been taxonomic; studies of macrophytobenthos, more extensive, though usually lacking in continuity, make effective comparisons with past conditions difficult. With glacial recession and land rebounding, changes in water depth are probably too gradual to cause the observed gross vegetational changes; long-range climatic changes are also likely to have been too slow for great effects in the period observed. Occurrence of heavy storms, seiches, fluctuations of sunshine and precipitation, and other short-range weather variables affect aquatic vegetation. Direct or indirect effects upon benthic plants through human activities (introducing foreign fish species and other organisms) have been observed. Summaries of phytoplankton studies indicate that very few offer detailed, reliable conclusions concerning plant community changes over the years. Long-range changes in dominant phytoplankters were demonstrated. There is evidence of rapid artificial eutrophication of Lake Erie. In both lakes, further quantitative seasonal studies of phytoplankton are needed. Phytogeographic problems are important. More is learned regarding water masses by examining planktonic biota than by sensitive chemical and physical measurements. Ecosystems must be clearly understood if they are to be intelligently managed for long-range benefits of mankind. (See W70-01942). (Jones-Wisconsin)
W70-01944

CHANGES IN THE BENTHOS OF LAKES ERIE AND ONTARIO,
Toronto Univ. (Ontario). Dept. of Zoology.
Ralph O. Brinkhurst.
Bulletin of the Buffalo Society of Natural Sciences, Vol 25, No 1, p 45-71, 1969. 11 fig, 21 ref.

Descriptors: *Lake Erie, *Lake Ontario, *Benthos, Oxygen, Eutrophication, Oligotrophy, Fish, Temperature, Pollution abatement, Mayflies, Oligochaetes, Tubificids, Currents (Water), Depth, Sodium, Sampling, Great Lakes region, Water pollution effects, Bioindicators.
Identifiers: *Biotic changes, Pontoporeia, Hyalella, Sphaeriid mollusks, Chironomids, Lumbriculidae, Pisidium forms.

Species composition of chironomid and oligochaete fauna in deepest parts of Lakes Erie and Ontario and Georgian Bay is fairly consistent with Beeton's trophic classification of these three lakes. The bottom fauna of Lake Erie suggests a west to east gradient from extremely eutrophic to moderately oligotrophic conditions. A similar south to north gradient is, at least partly, a reflection of temperature. Lake Ontario fauna suggests oligotrophy with possibly an eutrophic shore zone. Oxygen determinations of 10 years ago would be valuable. In grossly polluted situations, numbers of oligochaetes stay high; representatives of other groups may be scarce. Commonest oligochaete under such conditions is Limnodrilus hoffmeisteri. Proportion of oligochaetes to other forms of life, and the percentage of Limnodrilus hoffmeisteri in relation to all oligochaetes may be guides to degree of organic pollution. Difficulties in discussing the chironomid fauna include problems of nomenclature and systematics. The bottom fauna, potentially a good indicator of qualitative change, has been studied only superficially in the past. Since hard parts of chironomid larvae preserve well in lake sediments, core analyses might provide information on whether the distributions represent recent developments. (See W70-01942). (Jones-Wisconsin)
W70-01945

STUDIES OF THE PHYSIOLOGY AND ECOLOGY OF SPHAEROTILUS NATANS,
Oregon Agricultural Experiment Station, Corvallis.
H. K. Phinney, C. D. McIntire, W. H. Reese, J. M. Robertson, and C. E. Warren.
Terminal Report, Submitted to the Northwest Pulp and Paper Association, Mar 1, 1967. 31 p 16 tab, 4 fig, 4 ref.

Descriptors: *Sphaerotilus, *Sewage bacteria, *Water temperature, *Hydrogen ion concentration, *Nutrients, *Periphyton, *Ecology.
Identifiers: *Cell morphology, *Metabolic pathways, *Temperature and growth, *pH and respiration, *Nutrition of Sphaerotilus Laboratory communities, Isolation techniques, Culture techniques, Field methods.

Studies on the morphology, physiology and ecology of Sphaerotilus in the Laboratory and artificial streams were conducted. Amount of sheath material enclosing cells varied inversely with the amount of peptic and casamino acids in the culture medium. In pure culture Sphaerotilus grew at temperature of 3 to 35C and in the stream at 2C. Maximum rate of respiration at a pH of 7.5; no oxygen consumption at pH 6.0 and 5.7. Growth characteristics in a stream were observed and the population size depended on the supply of sucrose and urea. Diversity of other organisms was greater in areas of stream with little Sphaerotilus. Biomass of snails was greater; benthic insects were more abundant and trout production was greater in sections of the stream where Sphaerotilus was abundant. (Katz-Washington)
W70-01994

THE ACUTE TOXICITY OF SOME HEAVY METALS TO DIFFERENT SPECIES OF AQUATIC INSECTS,
National Water Quality Lab., Duluth, Minn.
STEPHEN L. Warnick, and H. L. Bell.
Journal Water Pollution Control Federation, Vol 41, No. 2, Part 1, p 280-284, Feb 1969. 3 tab, 12 ref.

Descriptors: *Copper, *Metals, *Aquatic insects, *Toxicity, Mayflies, Caddisflies, Fish food organisms, Bioassays.
Identifiers: *Iron salts, *Zu salts, *Cadmium salts, *Lead salts, *Copper salts, *Nickel salts, *Cobalt salts *Chromium salts, *Mercury salts, Stoneflies.

In static bioassays the acute toxicity of Cu, Zn, Cd, Pb, Cr, Hg, Co, Ni, and Fe salts on three species of stoneflies, mayflies and caddisflies was determined. The median tolerance limits of the metal salts for these organisms was determined. The mayfly was the most sensitive of the insects tested to all of the metals used. Insects seemed to be more tolerant than many species of fish. In the experimental procedures used, the 02, pH, and hardness remained fairly constant and these factors did not seem to influence mortalities. (Katz-Washington)
W70-01995

THE TOXICITY OF ENDRIN-RESISTANT MOSQUITOFISH TO ELEVEN SPECIES OF VERTEBRATES,
Mississippi State Univ., State College. Dept. of Zoology.
Peter Rosato, and Denzel E. Ferguson.
BioScience, Vol 18, No 8, p 783-784, Aug 1968. 1 tab, 4 ref. USPHS Grant No, UI 00348-01.

Descriptors: *Endrin, *Resistance, *Pesticide toxicity, DDT, Pesticides, Prey fish, Predation, Pesticide residues.
Identifiers: *Mosquitofish.

Mosquitofish and 5 additional species of fish were found resistant to a variety of chlorinated hydrocarbon insecticides. This study demonstrates the potential hazard of endrin-exposed resistant mosquitofish to eleven species of vertebrates. Resistant mosquitofish containing an average of 890.02 ppm of endrin were force-fed to redfin, pickerel, largemouth bass, bluegills, bullfrogs, redeared turtles, water snakes (several species), purple grackles, starlings, and quail. Controls, two of each species tested, were fed endrin-susceptible mosquitofish containing no pesticides. All controls survived and exhibited no symptoms of discomfort. Approximately 95% of the eleven species tested died from eating one endrin-treated fish. Findings show that resistant mosquitofish tolerate endrin residues sufficient to kill predators several hundred times their own weight. (Sjolseth-Washington)
W70-01996

EFFECTS OF FOREST SPRAYING WITH DDT ON AQUATIC INSECTS OF SALMON STREAMS IN NEW BRUNSWICK,
Toronto Univ. (Ontario). Dept. of Zoology.
F. P. Ide.
J Fish Res Bd, Canada, Vol 24 (4), p 769-805, 1967. 12 fig, 22 ref, 6 append.

Descriptors: *DDT, *Aquatic insects, Fish food organisms, Mayflies, Stonflies, Caddisflies, Pesticide toxicity.
Identifiers: *Salmon populations, Forest spraying, Spruce budworm, Miramichi river, Insect drift collections, Daily insect emergence, Recover, Bottom fauna.

Sampling of emerging aquatic insects by cage-traps on a 24-hr basis showed the effects on the stream fauna of spraying forests with DDT at 1/2 lb/acre in June. Except for a few individuals that presumably emerged from unaffected pupae and nymphs, there was an interval of several weeks after spraying when no emergency occurred. From about the middle of August, however, large populations of very small insects, mainly chironomids, emerged in the spray year. The year after spraying, as compared with the spray year, there was an increased variety including some larger species. In following years there was further recovery by increase in larger forms through reproduction from residual small populations. From the standpoint of feeding of the young salmon, significant facts are: (a) the severe reduction in the bottom fauna of larvae and nymphs of all sizes in the first weeks after spraying, (b) the large populations of small larvae, mainly chironomids, developing in late summer of the spray year and so available to fry; (c) increasing numbers of larger insects the year after spraying and subsequent years. (Sjolseth-Washington)
W70-01999

TOXICITIES OF FOUR INSECTICIDES TO RESISTANT AND SUSCEPTIBLE MOSQUITOFISH IN STATIC AND FLOWING SOLUTIONS,
Mississippi State Univ., State College. Dept. of Zoology.
W. David Burke, and Denzel E. Ferguson.
Mosquito News, Vol 29, No 1, p 96-101, Mar 1969. 2 fig, 12 ref. Grants ES 00086 and UI 00348 from U.S. PHS.

Descriptors: *Pesticide toxicity, Bioassay, DDR, Endrin, Resistance, Fishkill, Insecticides.
Identifiers: *Static tests, *Flowing tests, Mosquito fish, Toxaphene, Parathion, Population susceptibility.

The toxicity of parathion, toxaphene, DDT, and endrin in static and flowing test solutions to resistant and susceptible strains of mosquitofish was determined. Mortality-concentration curves and time-mortality curves were constructed. In both static and flowing tests, mortality was greater in susceptible fishes than in resistant fishes. The toxicity of a given concentration of DDT, toxaphene, and endrin is greater in flowing solutions than in static solutions. Parathion does not produce the same mortality pattern in resistant fish as do DDT, endrin and toxaphene. This is thought to result from the generation of a metabolite more toxic than parathion itself. This metabolite may be removed from the flowing system at a rate to preclude its buildup to toxic levels. The authors discuss the merits of static and flowing tests. (Sjolseth-Washington)
W70-02000

EFFECTS ON AQUATIC INSECTS OF FOREST SPRAYING WITH PHOSPHAMIDON IN NEW BRUNSWICK,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
C. D. Grant.
J Fish Res Bd Canada, Vol 24 (4), p 823-832, 1967. 9 fig, 2 tab, 5 ref.

Descriptors: *Aquatic insects, DDT, Diptera, Bottom sediments, Aquatic Populations, Pesticide toxicity.
Identifiers: *Phosphamidon, Aerial spraying, Spruce budworm, Emergence pattern, Insect drift collections.

No harmful effects on aquatic insects were detected in two New Brunswick streams after forest spraying with phosphamidon (1/2 - 1 lb/acre) in 1962 and 1963. Comparison of one pre-spray and two post-spray series of bottom samples showed no reduction in number or orders (and families in the case of Diptera) and no abnormal decline in the number of individuals. In numbers and variety of insects emerging daily into stream cages and of insects drifting onto vertical screens in the streams, no charges were attributable to phosphamidon. (Sjolseth-Washington)
W70-02001

SOME ENDRIN RELATIONSHIPS IN RESISTANT AND SUSCEPTIBLE POPULATIONS OF GOLDEN SHINERS, NOTEMIGONUS CRYSOLEUCAS,
Mississippi State Univ., State College. Dept. of Zoology.
J. Larry Ludke, Denzel E. Ferguson, and W. David Burke.
American Fish Soc Trans, Vol 97 (3), p 260-263, July 1968. 3 tab, 1 fig, 10 ref.

Descriptors: *Endrin, *Pesticide toxicity, Pesticide residues, Shiners, Resistance, Bioassay.
Identifiers: Endrin resistance, Resistant Populations Susceptible Populations

A 1000 ppb endrin solution killed 50 susceptible golden shiners in 75 minutes but only 40 of 50 resistant shiners in 40 hr. Endrin residues in whole bodies of resistant shiners killed in endrin were as much as 82 times those of susceptible shiners. The endrin concentrations in the blood of living resistant shiners were as much as 64 times greater than those of endrin-killed susceptible shiners. We conclude that the use of a critical concentration in the blood for diagnosis of endrin-caused mortality must be based on the tolerances of local populations and may be invalid when applied to an entire species containing resistant populations. (Sjolseth-Washington)
W70-02003

BIOLOGICAL EFFECTS OF OIL POLLUTION - BIBLIOGRAPHY, A COLLECTION OF REFERENCES CONCERNING THE EFFECTS OF OIL ON BIOLOGICAL SYSTEMS,
Federal Water Pollution Control Administration, Edison, N.J. Water Quality Lab.
Donna R. Radcliffe, and Thomas A. Murphy.
Available from Clearinghouse as PB-188 206 $3.00 in paper copy, 0.65 in microfiche. FWPCA Water Pollution Control Series, DAST-19, Oct 1969. 46 p, 500 ref. FWPCA Program Number 15080 FHU 10/69.

Descriptors: Aquatic animals, Aquatic plants, *Bibliographies, Biodegradation, Birds, *Environmental effects, Marine animals, Marine plants, *Oil, *Water pollution effects, Oily water, Oil-water interfaces.
Identifiers: Oil spillage.

References on the biological effects of oil are listed according to the following categories: Publications on the General Aspects of Oil Pollution, Reports of Oil Spill Incidents, General Biological Effects of Oil and of Specific Oil Spill Incidents, Effects of Oil on Birds, Effects of Oil on Fish, Effects of Oil on Shellfish, Effects of Oil on Freshwater Invertebrates, Effects of Oil on Plants, Effects of Oil on Dissolved Oxygen, Carcinogenic Effects of Oil, and Miscellaneous Biological Reports on Oil.
W70-02038

5D. Waste Treatment Processes

PERFORMANCE OF POROUS CELLULOSE ACETATE MEMBRANES FOR THE REVERSE OSMOSIS TREATMENT OF HARD AND WASTE WATERS,
Ottawa Pollution Control Center (Ontario); and National Research Council of Canada, Ottawa (Ontario). Div. of Applied Chemistry.
Andrew R. Hauck, and S. Sourirajan.
Environ Sci and Technol, Vol 3, No 12, p 1269-1275, Dec 1969. 7 p, 1 fig, 8 tab, 17 ref.

Descriptors: *Water treatment, *Desalination processes, *Water reuse, *Waste water treatment, *Reverse osmosis, Demineralization, Membranes, Membrane processes, Ions, Solutes, Industrial wastes, Reclaimed water, Alkylbenzene sulfonates.
Identifiers: Deionization.

The performance of a few typical Loeb-Sourirajan type porous cellulose acetate membranes is reported for the treatment of hard, polluted, and sewage waters. The membranes used are specified in terms of pure water permeability constant and solute transport parameter for sodium chloride. Using feed waters containing 300- to 800 ppm hardness, product waters containing 2 ppm or less could be obtained with 90% product recovery and an average initial flux of 38 gpd per sq foot at 1000 psig. The possibility of producing 'ultrapure' waters by repeated reverse osmosis processing is indicated. The separation of common pollutants such as nitrates, borates, fluoride, alkyl benzene sulfonate (ABS), ammonia, phosphates, and a few others usually present in plating wastes, and the ap-

plicability of the reverse osmosis process for the treatment of sewage waters and water renovation are illustrated. (Knapp-USGS)
W70-01644

ELECTROSORPTION AND DESORPTION PROCESS FOR DEMINERALIZATION,
Southern Research Inst., Birmingham, Ala.
For primary bibliographic entry see Field 03A.
W70-01671

FREON-12 HYDRATE DESALTING PROCESS,
Mason-Rust, Lexington, Ky.
For primary bibliographic entry see Field 03A.
W70-01677

FACTORS RESPONSIBLE FOR NON-BIODEGRADABILITY OF INDUSTRIAL WASTES,
Texas A and M Univ., College Station. Dept. of Civil Engineering, and Rice Univ., Houston, Tex.
Robert L. Irvine, and Arthur W. Busch.
J Water Pollut Contr Federation, Vol 41, No 11, Part 2, p R482-R491, Nov 1969. 10 p, 2 fig, 25 ref.

Descriptors: *Biodegradation, *Industrial wastes, *Waste treatment, Water chemistry, Oxidation, Chemical oxygen demand, Biochemical oxygen demand, Biological treatment, Sewage treatment.
Identifiers: Non-biodegradable wastes.

Feedback from biochemistry can allow introduction of innovative concepts in biological waste treatment. The specific problem treated deals with the meaning of 'non-biodegradability' and the possible means of biologically removing 'non-biodegradable' materials. The analysis is divided into three categories: (1) Low molecular weight compounds originally present in the influent stream waste. (2) Intermediates and end-products of biological activity found in the effluent waste stream. (3) High molecular weight compounds. After each analysis, a brief discussion indicates how these concepts may be used to develop new treatment practices. (Knapp-USGS)
W70-01689

SODIUM ADSORPTION RATIO INFLUENCE ON STABILIZATION POND SEALING,
South Dakota School of Mines and Technology, Rapid City. Dept. of Civil Engineering, and South Dakota State Univ., Brookings. Dept of Civil Engineering.
Floyd L. Matthew, and Leland L. Harms.
J Water Pollut Contr Federation, Vol 41, No 11, Part 2, p R383-R391, Nov 1969. 9 p, 4 fig, 3 tab, 9 ref.

Descriptors: *Permeability, *Oxidation lagoons, *Water quality, *Sodium, *Clays, Ion exchange, Clay minerals, Expansive clays, Linings, Seepage, Leakage, Water loss, Soil chemistry.
Identifiers: Sodium absorption ratio.

The different sealing effects of various sodium adsorption ratios, found in natural water supplies, on wastewater stabilization ponds were determined. Ten soil samples were studied and classified. Changes in permeability constants were determined for each sample using waters with sodium adsorption ratios of 0, 10, 40, and 80. The results indicated that the sodium adsorption ratio of the applied wastewater can influence the permeabilities of stabilization pond soils. The normal correlation was one of decreasing permeability as the sodium adsorption ratio was increasing. Greater ion exchange effects were disclosed in soils having lower liquid limits. (Knapp-USGS)
W70-01690

DEGRADATION OF SELECTED CHLORINATED HYDROCARBON INSECTICIDES,
Auburn Univ., Ala. Dept. of Civil Engineering.
Gerald M. Leigh.
J Water Pollut Contr Federation, Vol 41, No 11, Part 2, p R450-R460, Nov 1969. 11 p, 3 fig, 3 tab, 33 ref.

Descriptors: *Biodegradation, *Pesticides, *Chlorinated hydrocarbon pesticides, Gas chromatography, Water pollution treatment, Heptachlor, DDT, Endrin, Path of pollutants, Water chemistry.
Identifiers: Lindane.

The chemical and biological degradation of selected chlorinated hydrocarbon insecticides in aqueous solution was studied by means of electron-capture gas chromatography. Lindane, heptachlor, DDT, and endrin were subjected to the action of the oxidants chlorine, potassium permanganate, and potassium persulfate. None of the oxidants were effective in removing lindane or endrin. Less than 20-percent DDT removals were observed using potassium permanganate or potassium persulfate. Potassium permanganate removed more than 80 percent of the heptachlor in less than 5 hr. Alkaline decomposition of lindane and DDT was observed. Biological studies revealed that lindane is not subject to aerobic biodegradation. Heptachlor decomposes in aqueous solution to 1-hydroxy chlordene and an undetermined compound. Heptachlor removals as large 99.4% were observed to occur within 4 days. (Knapp-USGS)
W70-01696

EVALUATION OF BRINE DESULFATING PROCESS AS APPLIED TO DESALINATION PHASE I,
Catalytic Construction Co., Philadelphia, Pa.
G. P. Gelblum, W. Pechenick, and C. E. Ennis.
OSW R AND D Progr Rept No 289, Oct 1967. 42 p, 8 tables, 9 fig, 5 ref.
Identifiers: *By-product manufacturing processes, *Economic evaluations, *Feedwater treatment, Capitalized costs, Chemical by-products, Conceptual designs, Design, Flowsheets, Ion exchangers, Removal from feedwater, Sulfate, Scale prevention, Wrightsville Beach plant.

An adaptation of a brine desulfating process originally conceived by the Salt Lake Metallurgy Research Center of the Bureau of Mines was made to treat desalting plant feedwater. Sulfate removal, achieved by treatment with barium resins, was adequate to permit brine temperatures in excess of 350 deg F. By-products in the form of caustic soda, soda ash, and sulfuric acid produce a credit equal to 7 cents/1000 gal of product water from a desalter in the 50-mgd range. Construction and operating costs are detailed.
W70-01722

CALCIUM SULFATE SCALING IN SALINE WATER DISTILLATION,
Monsanto Research Corp., Everett, Mass.
C. H. Lu, and B. M. Fabuss.
Ind Eng Chem Process Design Develop 7, p 206-12, 1968. 7 fig, 4 tab, 31 ref.
Identifiers: *Physical chemistry of scale, *Scaling, Feedwater treatment, Literature surveys, Removal from feedwater, Calcium, Scale prevention, Thermodynamics.

A calculated solubility diagram for calcium sulfate in sea water concentrates is presented. Precipitation limits of calcium sulfate in sea water of different concentrations, determined by heating and evaporation experiments, are given. Great differences in precipitation limits and scale formation were observed in heating (nonboiling heat transfer) and in evaporation (boiling heat transfer) experiments. Effects of the heating surface materials, heating and evaporation rates, residence time, and seeding on the amount of precipitation were very minor. Literature data on scale formation in demonstration plants and pilot plants are presented on the solubility diagram.
W70-01729

ION EXCHANGE PRE-TREATMENT FOR SEA WATER DESALINATION PLANTS,
Maschinenfabrik Augsburg-Nuernberg A.G., Gustavsburg (West Germany).
G. K. Kunz.
Desalination 3, p 363-72, 1967. 24 fig, 1 ref.
Identifiers: *Feedwater treatment, *Ion exchanging, *Physical chemistry of scale, Columns (Process), Distillation processes, Ion exchangers, Scale prevention, Scaling.

A study is made of the dependence of the saturation concentrations of calcium sulphate, anhydrite and hemihydrate modifications on temperatures and concentration factors. The conversion of the hemihydrate phase into the anhydrite phase, whose speed was measured, proved to be of particular importance. Partial softening of seawater by means of ion exchange, using the brine concentrated in the evaporators as a regenerant, reduces calcium ion concentration to such an extent that no deposits occur. Results obtained in discontinuous laboratory experiments show the dependence on the various limiting quantities. The degree of softening can be considerably increased if the ion exchange is carried out continuously, countercurrently. The apparatus used for a typical plant consists of countercurrent columns, the absorption column operating by stages. No pumps are required for the circulation of the resin- regulation is by automatic control of a single valve. The results of the operation of a pilot plant are given with particular reference to the exchange efficiency. The combination with the saturation concentrations of calcium sulphate shows that even with low concentration factors the maximum operating temperatures can be as high as 160 deg C without the solubility limit of the calcium sulphate hemihydrate being exceeded.
W70-01730

POTABLE WATER FROM SEAWATER BY HIGH-TEMPERATURE ELECTRODIALYSIS,
IONICS, Inc., Watertown, Mass.
W. A. McRae.
IN Abundant Nuclear Energy, Proc Symp Gatlinburg, Tenn, Aug 1968. p 269-98, 10 fig, 9 tab, 20 ref. AFC Symp Ser 14 (CONF-680810) 1969.
Identifiers: *Brackish water, *Electrodialysis process, *Water costs estimate, Capitalized costs, Flowsheets, Membrane processes.

Electrodialysis plants which can produce hundreds of millions of gallons daily and which operate at or near ambient temperatures can be installed now. Static tests on membranes at high temperatures show that thermal decomposition of the ion-exchange resin per se will probably not be a serious problem in practical apparatus. The electrical resistances of both membranes and saline water are shown to decrease at a compound rate of about 1%/deg F, and current efficiency is found to be essentially invariant with temperatures. These findings are confirmed by the operation of laboratory electrodialysis apparatus at 180 deg F for up to 4 months at the time this paper was written. Cost are estimated for producing 205 mgd of fresh water from seawater and from brackish water in high-temperature electrodialysis plants integrated with steam-turbine generators. The estimated total cost of producing fresh water from seawater ranges from 44 to 46 cents/1000 gal. Fresh water from 3000 ppm brackish water is estimated to cost 85 cents/1000 gal. Research opportunities are outlined which could reduce the total costs for demineralizing seawater to the range of 20 to 25 cents/1000 gal.
W70-01731

APPLICATION OF LOW-COST ENERGY TO PROCESSING OF SEWAGE WATER FOR REUSE,
Oak Ridge National Lab., Tenn.
I. Spiewak.
IN Abundant Nuclear Energy, Proc Symp Gatlinburg, Tenn, Aug 1968. p 239-47, 5 fig, 3 tab, 2 ref. AEC Symp Ser 14 (CONF-680810) 1969.
Identifiers: *Waste disposal, *Water utilization, Electrodialysis process, Pollution, Wastes.

Water supply and sewerage systems for a city of 2 million are analyzed. Examples are given of a conventional system, a system using advanced waste treatment, and a system using complete wastewater recycle. Low-cost energy has a significant impact only on the water recycle system, which includes a unique desalting process combining electrodialysis and distillation. Waste solids are distilled to dryness. The cost of the total water system ranges from 33 cents/1000 gal for the conventional system to 45 cents/1000 gal for the water recycle system.
W70-01741

OPTIMIZATION OF ACID WASTE SLUDGE CHARACTERISTICS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Civil Engineering.
J. F. Judkins, Jr. and W. A. Parsons.
J Water Pollut Contr Federation, Vol 41, No 9, p 1625-1634, September 1969. 10 p, 10 fig, 1 tab, 10 ref.

Descriptors: *Optimization, *Acidity, *Waste disposal, *Filtration, *Settling Velocity, Sampling, Design, Sludge treatment, Mixing, Industrial wastes.
Identifiers: Crystal seeding process.

An investigation of the effects of the crystal seeding process on the filterability of lime-sulfuric acid in industrial waste sludges was conducted. The objective of the study was the optimization of the crystal seeding and the provision of information which would be useful for the design of improved processes for the control of water pollution from acid waste charges. Seed dosage, mixing rate, acid concentration and crystal seed age were the variables that were selected for consideration in the investigation. A minimum of three replicate samples were run for individual values of the chosen variables, and the sludge parameters were determined for each sample. Sludge filterability, as measured by specific resistance, and sludge settleability, was determined for each sample. The results implied that crystal seeding could improve the settleability and filterability of sludge formed on lime neutralization of dilute, metal bearing sulfuric acid waste solutions. Optimum values of crystal seed dosage, mixing rate, and acid concentration were formed to be associated with maximum effectiveness of the crystal seeding process. (Thiuri-Cornell)
W70-01763

SLUDGE DISPOSAL AND THE MARINE ENVIRONMENT,
Municipality of Metropolitan Seattle, Wash.
For primary bibliographic entry see Field 05E.
W70-01764

CHEBYSHEV OPTIMAL WASTE DISCHARGES,
Yale Univ., New Haven, Conn. Dept. of Administrative Sciences.
Matthew J. Sobel.
Dept Admin Sci, Rep No 17, Yale Univ, p 1-28, September 1969. 28 p, 8 ref.

Descriptors: *Waste storage, *Optimization, *Water resources, *Water quality control, *Storage capacity, Discharge (Water), Mathematical models, Waste water disposal.
Identifiers: Chebyshev criterion.

The study provided a model for evaluating alternative schedules for storing wastes and discharging stored wastes into a water resource. Equivalently the model related the capacity of the waste storage facility to whatever base level could be ensured for water quality. Two discrete-time deterministic problems were considered (a) for a given storage capacity, what discharge schedule maximized the minimum water quality during a finite horizon (b) for a given minimum water quality during a finite horizon, what was the smallest storage capacity for which there existed a feasible discharge schedule. The Chebyshev criterion was employed to provide optimal solutions to (a) and (b). The criterion was also exploited computationally to obtain exact solutions to (a) and approximate solutions to (b). (Thiuri-Cornell)
W70-01767

OPTIMIZATION OF THE ION FLOTATION OF DICHROMATE,
Kentucky Univ., Lexington; and Tenco Hydro/Aeroscience Inc., Chicago, Ill.
Robert B. Grieves, Gregory A. Ettelt, J. Thomas Schrodt, and Dibakar Bhattacharyya.
ASCE, J Sanit Eng Div, Vol 95, No SA3, p 515-525, June 1969. 11 p, 5 fig, 2 tab, 10 ref, 2 append.

Descriptors: *Optimization, *Ions, *Flotation, *Surfactants, *Volume, Regression analysis, Waste treatment, Chemicals, Cost analysis, Foam fractionation.
Identifiers: Dichromate.

The efficiency of a pilot-plant scale, dissolved-air ion flotation unit for the removal and concentration of dichromate was evaluated. The evaluation was dependent on three variables: the fractional flotation (removal) of dichromate, the enrichment ratio for dichromate, and the fractional flotation (removal) of surfactant. Each dependent variable was related analytically to five independent variables by multiple regression analysis. Optimum values of the independent variables were determined and a chemical cost estimate based on the removal of chromium was carried out. The prime advantage of the ion flotation process was the concentration of the chromium present in the waste (together with the surfactant added) in a small liquid volume of collapsed foam. Chromium was concentrated in a liquid volume less than one per cent of the volume of the waste. (Thiuri-Cornell)
W70-01768

THE BIOLOGICAL EFFECTS OF OIL POLLUTION ON LITTORAL COMMUNITIES. PROCEEDINGS OF A SYMPOSIUM, ORIELTON FIELD CENTRE, PEMBROKE, WALES, 17-19, February, 1968.
For primary bibliographic entry see Field 05C.
W70-01776

RECLAIMING SEWAGE EFFLUENT,
Arizona Univ., Tucson. Water Resources Center.
L. G. Wilson, and G. S. Lehman.
Progressive Agriculture in Arizona, Vol 19, No 4, July-Aug 1967, p 22-24. 2 fig.

Descriptors: *Sewage treatment, *Arizona, *Filtration, *Bermudagrass, *Chemical oxygen demand, Sewage effluents, Tertiary treatment, Waste water treatment, Biochemical oxygen demand, Water quality, Water reuse, Reclaimed water.

The authors report preliminary results of three trials of the effectiveness and durability of grass plot filters for tertiary treatment of municipal sewage effluent under Arizona conditions. It was found that grass height and density should be great enough to ensure true filtration. Bermudagrass can tolerate prolonged flooding with sewage effluent. A substantial part of the effluent percolated downward from the filter plots toward the water table. Therefore, subsurface materials would act as soil filter for part of the effluent. COD (Chemical Oxygen Demand) was found to be a more reliable measure than BOD (Biological Oxygen Demand) in samples containing high algae content. Outlet COD values were consistently lower than inlet values, indicating that the units acted as true filters. (Crouse-Arizona)
W70-01831

COMBINED UNDERFLOW-STORAGE PLAN FOR POLLUTION AND FLOOD CONTROL IN THE CHICAGO METROPOLITAN AREA.
Department of Public Works, Chicago, Ill. Bureau of Engineering.
For primary bibliographic entry see Field 05G.
W70-01869

SECONDARY EFFLUENT DEOXYGENATION AT DIFFERENT TEMPERATURES,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
A. E. Zanoni.
Journal Water Pollution Control Federation, Vol 41, No 4, p 640-659, Apr 1969. 11 fig, 2 tab, 23 ref.

Descriptors: *Biochemical oxygen demand, *Nitrification, Temperature, Biological treatment, Sewage effluents, Sewage treatment.
Identifiers: Carbonaceous deoxygenation, Arrhenius expression, Jug dilution technique, Reaction rates.

The effect of temperature on the rate of deoxygenation of raw wastewater has been examined frequently. There is evidence to indicate, however, that secondary effluents do not necessarily behave in a similar manner. In this study, the relationship between temperature and the rate of both the carbonaceous and the nitrogenous deoxygenation of an effluent from a conventional activated sludge wastewater treatment plant is determined. A 'jug' dilution technique was used for the biochemical oxygen demand determinations. Numerous nitrite and nitrate-nitrogen analyses also were conducted to establish the kinetics of the nitrogenous phase of deoxygenation. The resulting data are employed primarily to calculate the temperature coefficient of the modified Arrhenius expression. The dependence of both the first and second stage ultimate demands on temperature is investigated. The first-stage rate constant increased 11.5% per C deg from 5 to 10 deg C, 6.9% per C deg from 10 to 26 deg C, and decreased 2.1% per C deg above 26 deg C. The second stage-rate constant increased 9.2% per C deg from 10 to 20 deg C, and decreased 5.5% per C deg from 20 to 30 deg C. The ultimate demands did not vary significantly with temperature. The nitrification lag time was a strong function of temperature, being 4 days at 30 deg C and 16 days at 10 deg C. (Rietveld-Vanderbilt)
W70-01921

WASTE WATER DEOXYGENATION AT DIFFERENT TEMPERATURES,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
A. E. Zanoni.
Water Research, Vol 1, p 543-566, Aug-Sept, 1967. 13 fig, 2 tab, 34 ref.

Descriptors: *Biochemical oxygen demand, *Sewage, *Temperature.
Identifiers: Deoxygenation constants, Deoxygenation activity, Dilution technique, First stage velocity constant, Ultimate oxygen demand, Arrhenius expression, Second order reaction rate equation.

A large number of biochemical oxygen demands (BOD) determinations were conducted on a raw municipal sewage using the dilution technique and at incubation temperatures ranging from 2 to 40 deg C. At incubation temperatures of 20 deg C and above, BOD determinations were conducted at one-sixth, one-third, one-half, 1, 3, 5, and 7 days. At lower temperatures, determination under one day were not conducted, though these test runs were extended for much longer periods. The data were used to evaluate the first stage velocity constant, k, and ultimate demand, L, of the first-order deoxygenation expression, and these, in turn, were related to temperature. It was found that k increased by 12.6% per C deg from 2 deg to 15 deg C, by 4.7% per degree from 15 deg to 32 deg C, and decreased by 1.5% per C deg from 32 deg to 40 deg C. The ultimate demand also varied with temperature above 20 deg C. It was also found that the deoxygenation kinetics could be more accurately described by a second order reaction rate equation than by the conventional first order equation. (Rietveld-Vanderbilt)
W70-01927

HIGH-TEMPERATURE DESALINATION PLANTS FOR NUCLEAR POWER STATIONS,
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
For primary bibliographic entry see Field 03A.
W70-01955

CHARACTERIZATION OF SETTLING TANKS BY EDDY DIFFUSION,
Engineering-Science, Inc., Oakland, Calif. Research and Development Lab.
Hassan M. El-Baroudi.
J Sanit Eng Div, Proc Amer Soc Civil Eng, Vol 95, No SA3, Proc Paper 6618, p 527-544, June 1969. 12 fig, 15 ref.

Descriptors: *Diffusion, *Settling basins, *Sedimentation, Turbulence, Mathematical models, Sanitary engineering, Analysis.
Identifiers: *Turbulent diffusion, Eddy diffusion, Models, Similarity, Hazen number, Camp number.

A model settling basin study is described of eddy diffusion by using radioactive tracers. A derivation is presented of an eddy diffusion equation based on random dispersion (the normal distribution). The inlet structure gives near ideal mixing; therefore, the source is assumed to be an exponentially-decreasing extended source. The calculated and observed concentrations with time are graphically presented. A similarity rule is proposed for modeling settling tanks. The rule uses both Hazen and Camp numbers for the model and the prototype and approaches Reynold's law as the coefficient of eddy diffusion increases. (Ledbetter-Texas)
W70-01970

SULFIDE PRODUCTION IN WASTE STABILIZATION PONDS,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
Earnest F. Gloyna, and Ernesto Espino.
J Sanit Eng Div, Proc Amer Soc Civil Eng, Vol 95, No SA3, Proc Paper 6637, p 607-628, June 1969. 19 fig, 4 tab, 17 ref.

Descriptors: *Sulfides, *Oxidation lagoons, *Design, *Sulfur bacteria, Stabilization, Waste water, Algae, Diffusion, Sulfur.
Identifiers: *Sulfate ion, *Desulfovibrio, Facultative, BOD, Detention time.

The production and release of hydrogen sulfide from waste stabilization ponds and required design modifications, resulting from increased sulfate or hydrogen sulfide content are discussed. A 6-ft deep facultative model pond was operated under seven different operating conditions. The objective of the experiments was to study the relationships between sulfide concentration. (Ledbetter-Texas)
W70-01971

CHEMICAL COAGULATION OF KRAFT MILL WASTEWATER,
California Univ., Berkeley; Mississippi State Univ., State College; and International Paper Co., Mobile, Ala.
E. J. Middlebrooks, W. E. Phillips, Jr., and Frank J. Coogan.
Water and Sewage Works (Industrial Wastes Supplement) Vol 116, No 3, p IW/7-IW/9, Mar 1969. 4 fig, 1 tab, 4 ref.

Descriptors: *Coagulation, *Pulp and paper industry, Pulp wastes.
Identifiers: *Polyelectrolytes, *Aluminum sulfate, Kraft mill wastes, Anionic, Cationic, Nonionic.

The literature of coagulation of paper mill wastes is reviewed, and the results of experiments run on 6 organic polyelectrolytes (DOW) and aluminum sulfate are reported. The percentage COD was reduced an average 54 percentage; suspended solids and color were reduced about 95. The percentage BOD reduction was less than 20. A dosage of about 4 mg/l for polyelectrolyte and about 40 mg/l for alum was sufficient when the pH was optimal. (Ledbetter-Texas)
W70-01972

A CASE OF FILAMENTOUS ACTIVATED SLUDGE,
Instituut voor Gezondheidstechniek TNO, The Hague (Netherlands).
A. Pasveer.
J Water Pollut Contr Federation, Vol 41, No 7, p 1340-1352, July 1969. 10 fig, 2 tab, 13 ref.

Descriptors: *Fungi, *Activated sludge, *E. coli oxidation lagoons, Sphaerotilus, Wastewater treatment, Aeration.
Identifiers: *The Netherlands, *Filamentous growth, Bulking, Ribonucleic acids, Deoxyribonucleic acids.

A case of light sludge in the oxidation ditch of the Sancta Maria hospital in The Netherlands was investigated. To treat the normal domestic wastewater (15 cu m/hr, 500 mg/l BOD) emanating from the hospital, a 450-cu m oxidation ditch had been constructed. During operation a heavy filamentous growth caused bulking and poor operation. Although past research indicated that the bulking organisms might be Sphaerotilus, laboratory tests under conditions simulating those that were felt to exist in the continuous-fed, constantly aerated oxidation ditch indicated that the organism responsible was filamentous-shaped E. coli. The author presents reasons for this assumption and includes microphotographs. Elimination of the filamentous organisms was accomplished by intermittent feeding (60 cu m/hr for 1 hr) followed by 4-hr aeration, 1-hr sedimentation, and then repeating. (Ledbetter-Texas)
W70-01973

BRITISH PRACTICE IN THE TERTIARY TREATMENT OF WASTEWATER,
Watson (J. D. and D. M.), London (England).
H. R. Oakley, and Terence Cripps.
J. Water Pollut Contr Federation, Vol 41, No 1, p 36-50, Jan 1969. 5 fig, 4 tab, 13 ref.

Descriptors: *Tertiary treatment, *Wastewater, *Lagoons, Phosphates, Standards, Filtration, Legislation, Irrigation.
Identifiers: *Microstraining, *British Isles, Rapid sand filtration, Slow sand filtration, Phosphate removal, Nitrogen removal, Pebble bed clarifiers.

British practice is reviewed in the tertiary treatment of wastewater and specific examples are described with particular reference to experience with effluent lagoons at the Rye Meads Works of the Middle Lee Regional Drainage Scheme. A brief historical review serves to indicate the factors which have governed the methods adopted and is followed by a description of current practice in effluent polishing by land irrigation, microstraining, and sand filtration, and effluent lagoons. A critical comparison is made of these methods. The design and performance of the effluent lagoons at the Rye Meads Works is described in some detail and there is discussion of the current investigations on the control of algae in lagoons and receiving streams. (Ledbetter-Texas)
W70-01974

PHOSPHATE REMOVAL BY A LIME-BIOLOGICAL TREATMENT SCHEME,
Kansas State Univ., Manhattan; and Kansas Univ., Lawrence.
Lawrence A. Schmid, and Ross E. McKinney.
J Water Pollut Contr Federation, Vol 41, No 7, p 1259-1276, July 1969. 10 fig, 3 tab, 9 ref.

Descriptors: *Biological treatment, *Phosphorus, *Lime, *Phosphates, Costs, Nutrients, Wastewater treatment.
Identifiers: *Cell synthesis, *Lime regeneration, *Sludge production, pH.

A process (based on laboratory studies) is proposed for the removal of phosphorus from domestic wastewater by lime treatment of effluent by a high-rate, complete mix activated sludge process. This treatment allows for partial removal of the phosphorus by the lime with the activated sludge organisms removing the remaining portion by synthesis into cell mass. The addition of 150 mg/l calcium hydroxide to raw waste-water resulted generally in a pH of 9.5 phosphate removals of 80 percent, BOD removals of 60 percent, and SS removals of 90 percent. The activated sludge process was found to operate satisfactorily on the lime-treated wastewater, and microbial production of carbon dioxide in the activated sludge unit was sufficient to maintain a pH near neutral in the aeration compartment. (Ledbetter-Texas)
W70-01976

PLANNING INDUSTRIAL WASTE TREATMENT,
New York State Department of Health, Albany.
Hayse H. Black.
J Water Pollut Cont Federation, Vol 41, No 7, p 1277-1284, July 1969. 2 ref.

Descriptors: *Permits, *State jurisdiction, *Construction, *Design standards, *Planning, Industrial wastes, Waste water treatment, Sewage treatment, Surveys.
Identifiers: *Construction permits, *State agencies, Process.

Policies followed by the New York State Department of Health are detailed in reviewing applications for permits for the design, construction, and operation of industrial waste treatment works. Subject areas considered are: project delineation, proposed plant and process description, factory operations, development of design criteria, and combined treatment with domestic wastes. Although not all suggestions for investigation will apply to every project, the principles set forth are applicable to the sound engineering design of industrial waste treatment systems. (Ledbetter-Texas)
W70-01977

ADVANCED WASTEWATER CONTROL SYSTEM,
Yeomans Brothers Co., Melrose, Ill.
Edward F. Bradley.
J Water Pollut Cont Federation, Vol 41, No 7, p 1292-1298, July 1969. 3 fig, 2 ref.

Descriptors: *Wastewater, *Lagoons, *Monitoring, *Wastewater treatment, Disinfection, Instrumentation, Ultraviolet radiation.
Identifiers: *Research project, *St. Michaels, Maryland, Effluent shutoff, Continuous monitoring, Automatic monitoring.

Because, from a public health standpoint, the effluent from a normally operated domestic wastewater treatment plant has adverse effects on the receiving water, a new treatment process has been developed which provides for effective pathogen removal and absolute continuous control over the quality of the treatment plant effluent. This treatment is accomplished by controlled flow, continuous automatic equipment monitoring, continuous automatic evaluation of the degree of treatment provided, detection of equipment malfunction, instantaneous notification of authorities, and automatic stoppage of flow to the receiving waters. A research project at St. Michaels, Maryland, is expected to provide sufficient test data to verify the validity of the system under full-scale conditions, and also should demonstrate the usefulness of ultraviolet light as a means of disinfection comparable to present chlorination methods. (Ledbetter-Texas)
W70-01978

STRUCTURAL DETERMINANTS IN THE OXIDATION OF ALIPHATIC COMPOUNDS BY ACTIVATED SLUDGE,
Ohio State Univ., Columbus. Dept. of Microbiology.
George W. Malaney, and Robert M. Gerhold.
J Water Pollut Contr Federation, Vol 41, No 2, Part 2, p R18-R33, Feb 1969. 12 fig, 7 tab, 30 ref.

Descriptors: *Activated sludge, *Amino acids, *Oxidation, Wastewater treatment.
Identifiers: *Aliphatic compounds, *Columbus (Ohio), Nitriles, Amides, Amines, Carboxylic acids.

The abilities are delineated of 3 activated sludges (Columbus, Ohio) to oxidize the following chemical families: saturated monocarboxylic acids; saturated and unsaturated hydroxy and keto dicarboxylic acids; nitriles; amides; amines; and amino acids. They used a Warburg respirometer with chemical concentrations up to 500 mg/l and solids of 2500 mg/l. They found that saturated mono-carboxylic acids were oxidized immediately; unsaturation in long-chain mono-carboxylic acids increases oxidation amenability; most di-carboxylic acids resist oxidation; the cyanide group decreases oxidation; aliphatic amines were toxic; and amino acid oxidation varied greatly. (Ledbetter-Texas)
W70-01979

KINETICS OF SUBSTRATE UPTAKE IN PURE AND MIXED CULTURE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
R. I. Mateles, and S. K. Chian.
Environ Sci Technol, Vol 3, No 6, p 569-574, June 1969. 13 fig, 21 ref.

Descriptors: *Kinetics, *Activated sludge, *Cultures, Mathematical models, Model studies, Carbon.
Identifiers: *Biokinetics, *Monod equation, *Zero order, Pure culture, Mixed culture, Continuous culture, Glucose, Lactose, Butyrate, Acetate, Steady-state, Residence time, Batch culture.

Laboratory models were used to study the rates of substrate uptake by various microorganism cultures obtained from a local polluted stream. Acetate production amounted to 15 percent of the carbon source used in a glucose-butyrate feed of a culture that was carbon-limited. The growth rate was 1 hr-sups-1 and the dissolved oxygen pressure was 0.1 atm. There have been no previous reports of acetate production by a carbon-limited continuous culture and current theory says th re should be none. The experiments indicate that complete analysis of media leaving a continuous culture or activated sludge process is necessary because of the appearance of catabolites in the effluent. Acclimatization should be carried out under flow conditions identical to those for the test. The steady state condition was reached after 10 to 25 residence times rather than the 5 or 6 usually reported. (Ledbetter-Texas)
W70-01980

REMOVAL OF NITROGEN AND PHOSPHORUS FROM WASTE WATER,
Stanford Univ., Calif.
Rolf Eliassen, and George Tchobanoglous.
Environ Sci Technol, Vol 3, No 6, p 536-541, June 1969. 2 tab, 15 ref.

Descriptors: *Nutrients, *Nitrogen, *Phosphorus, Efficiencies, Cost comparisons, Treatment, Biological treatment, Algal control, Ammonia, Ion exchange, Reverse osmosis, Distillation, Electrodialysis, Sorption, Chemical precipitation, Ultimate disposal.
Identifiers: *Nutrient removal, *Eutrophication, Anaerobic denitrification, Land application, Electrochemical treatment, Ammonia stripping, Algae harvesting.

The principal sources of nitrogen and phosphorus in wastewaters are tabulated with the amounts from each source; domestic and agricultural operations are on a par with industrial output for nitrogen discharges, but phosphorus releases by industry are not available. Nitrogen removal may be done by the following processes with removal efficiencies and cost in dollars per million gallons in parentheses: ammonia stripping (80-98, 9-25), anaerobic denitrification (60-95, 25-30), algae harvesting (50-90, 20-35) and conventional biological treatment (30-50, 30-100). A similar list for phosphorus removal follows: modified activated sludge (60-80, 30-100), chemical precipitation (88-95, 10-70), chemical precipitation with filtration (95-98, 70-90), and sorption (90-98, 40-70). In addition, the conventional biological treatment removes 10-30 percent of the phosphorus. A list of the treatment schemes for removal of both nitrogen and phosphorus is the following: ion exchange (80-92, 86-98, 170-300), electrochemical treatment (80-85, 4-8 for power), electrodialysis (30-50, 100-250), reverse osmosis (65-95, 250-400), distillation (90-98, 400-1000), and land application (60-90 phosphorus, 75-150). Ultimate disposal methods may be classified into 4 groups: dumping; subsurface injection; conversion and dumping; and conversion, product recovery, and dumping. (Ledbetter-Texas)
W70-01981

EXPERIENCE IN PROVIDING FOR SAFETY ASPECTS IN TREATMENT PLANT DESIGN,
Black and Veatch, Kansas City, Mo.
Lloyd W. Weller.
J Water Pollut Contr Federation, Vol 11, No 1, p 122-125, Jan 1969. 5 tab, 2 ref.

Descriptors: *Safety, *Accidents, *Design, *Wastewater treatment, Ventilation, Operation and maintenance, Explosions.
Identifiers: *Treatment plant design, Handrails, Kickplates, Toxic gas, Asphyxiation, Fires, Eye baths, Gas masks, Chlorine leak detectors.

Although an organized effort exists to promote safety in wastewater plants, the safety record of the wastewater field indicates there is urgent need for improvement. Designers must review their thinking and their design procedures to make sure that the safety of operating personnel is given prime consideration in the layout and arrangement of wastewater works. A review of two existing plants and their accident records, however, does suggest that most accidents have their cause in something other than a direct physical deficiency. Because the operation of water pollution control facilities makes exacting and varied the demands on the operating personnel, a total-environment approach toward accident prevention in the wastewater treatment facilities must be made. (Ledbetter-Texas)
W70-01983

THE SLUDGE VOLUME INDEX--WHAT IS IT,
Illinois Univ., Urbana; and North Carolina Univ., Chapel Hill.
Richard I. Dick, and P. A. Vesilind.
J Water Pollut Contr Federation, Vol 41, No 7, p 1285-1291, July 1969. 9 fig, 9 ref.

Descriptors: *Sludge, *Wastewater treatment, *Rheology, *Settling velocity, Activated sludge, Testing.
Identifiers: *Sludge volume index (SVI), Control tests, Thickening, Settling characteristics, Compression characteristics.

Although the sludge volume index (SVI) has become the standard measure of the physical properties of activated sludge, it is possible for sludges with identical SVI values to have vastly different physical properties. The SVI value for a sludge is not consistently related to the settling velocity, compression characteristics, suspended solids concentration, or rheological characteristics of the sludge. Futhermore, results of SVI tests are not indicative of settling characteristics in settling basins. The sludge volume index is a convenient control test in the operation of activated sludge plants, but comparisons of SVI values from various plants are not meaningful. The parameter is not suitable for research applications, and cannot be used to predict recycle requirements or mixed liquor suspended solids concentrations in the activated sludge process. It is suggested that alternate, more meaningful measurements of the physical characteristics of activated sludge be used where possible. (Ledbetter-Texas)
W70-01984

MANASSAS, VA., ADDS NUTRIENT REMOVAL TO WASTE TREATMENT,
Federal Water Pollution Control Administration, Cincinnati; Wiley and Wilson; and Prince William County, Va.
M. C. Mulbarger.
Water Wastes Eng, Vol 6, No 4, p 46-48, Apr 1969. 2 fig, 13 ref.

Descriptors: *Nutrients, *Phosphorus, *Nitrogen, Municipal wastes, Pilot plants, Nitrification, Denitrification, Sludge digestion.
Identifiers: *Luxury uptake, Chemical treatment, Experimental operation.

An experimental 1.0 mgd plant has been built at Manassas, Va., to study the removal of nutrients from wastewater while giving the waste stabilization treatment. A 0.2 mgd biological nitrification-denitrification pilot plant for nitrogen removal is located at the same site. The process will permit higher overall removals of phosphorus and nitrogen than coventional treatment and will remove the carbonaceous and solids materials in the usual amounts. The units are designed for flexibility of operation to provide experimental operation. Unconventional features of the plant are that it does not have primary clarification, and it uses two-stage turbine aeration, intermediate solid-liquid separation by flotation, and chemical precipitation of the digester supernatant. The phosphorus removal is to be by metabolic means, luxury uptake by microorganisms. (Ledbetter-Texas)
W70-01985

MODERN MONITORING OF A TREATED INDUSTRIAL EFFLUENT,
Procter and Gamble Co., Cincinnati, Ohio. Ivorydale Technical Center.
R. G. Ostendorf.
J Water Pollut Contr Federation, Vol 41, No 1, p 89-98, Jan 1969. 9 fig, 3 ref.

Descriptors: *Monitoring, *Biochemical oxygen demand, *Dissolved oxygen, *Industrial wastes, Wastewater, Evaporation, Incineration, Filtration, Flotation.
Identifiers: *Total carbon, *Suspended solids, *Susquehanna River, pH, Paper wastes, Screening, Composite sampler.

The wastes monitoring system is described installed by the Charmin Paper Products Company at their waste treatment facility. BOD wastes are evaporated then incinerated and fiber-bearing wastes are treated for suspended solids removal by screening, precoat filters, and dissolved air flotation. The wastes monitoring system used to maintain the DO in the Susquehanna River at the prescribed 5.0 mg/l concentration consists of composite sampler, pH recorder, DO and BOD analysis, and continuously indicating suspended solids and total carbon equipment. The total carbon and suspended solids analyzers are described. (Ledbetter-Texas)
W70-01986

FUNDAMENTALS OF ACTIVATED SLUDGE,
Department of Water Resources, New York. Bureau of Water Pollution Control.
A. H. Chasick.
J Water Pollut Contr Federation, Vol 41, No 7, p 1377-1382, July 1969. 1 tab, 1 ref.

Descriptors: *Activated sludge, *Aeration, *Sludge, *Fundamentals, Design data, Domestic wastes.
Identifiers: *Step aeration, *New York City, Overflow rates, Gravity thickeners, Process air, Excess sludge, Aeration tank loadings, Mixed liquor solids.

The operation fundamentals are discussed of activated sludge plants in the New York City area, treating weak-to-normal domestic wastewater. Overflow rates are 800 gpd/sq ft (32.7 cu m/day/sq

m) for tanks 200 to 300 ft (61 to 92 m) long. Return sludge pumps operate at 25 to 30 percent of wastewater flow. Gravity thickeners with maximum diameter of 70 ft (21.4 m) are used, with a design load maximum of 8 lb/day/sq ft (39 kg/day/sq m), to produce a sludge containing 5 to 6 percent solids. The operational parameter is the process air added to the aeration tanks - two mg/l air is kept at the aerator outlet. Aeration tank loading rates are 0.20 to 0.33 lb/day (0.10 to 0.15 kg/day); mixed liquor solids content varies from 960 to 1600 mg/l (6-hr detention, 100 mg/l primary effluent solids). The typical four-pass step aeration process has aeration tank loadings of 50 to 60 lb BOD/1000 cu ft of aeration tank. Excess sludge, sludge index, and final tank loadings are also discussed. (Ledbetter-Texas)
W70-01987

WATER RECLAMATION AT SOUTH TAHOE,
South Tahoe Public Utility District, South Lake Tahoe, Calif.
Russell Culp.
Water Wastes Eng, Vol 6, No 4, p 36-39, Apr 1969. 5 fig, 4 tab.

Descriptors: *Tertiary treatment, *Reclamation, *Water reuse, Activated sludge, Activated carbon, Biochemical oxygen demand, Chemical oxygen demand, Odor, Coliforms, Phosphorus, Turbidity, Filtration.
Identifiers: *Nitrogen stripping, Suspended solids, Color, Operating data, Sludge incineration, Carbon regeneration.

A 7.5 mgd water reclamation plant which employs advanced wastewater treatment practices has been operating for 9 mos with good results. The water is used for irrigation of alfalfa, other hay, and pasture land. There are plans to use the water for contact sports. The process starts with chlorination for odor control, then continues with a conventional activated sludge treatment with some recirculation of lime sludge for phosphorus removal. The effluent from the conventional treatment receives 5 steps of tertiary treatment: flocculation and coagulation with phosphorus removal (lime), nitrogen stripping, recarbonation, filtration, activated carbon columns, and chlorination. The sludges are incinerated with recovery of lime and carbon dioxide. The plant removes nearly 100 percent of the BOD, COD, suspended solids, color, odor, coliforms and turbidity. The removal of phosphorus is about 94 percent and of nitrogen is greater than 50 percent. The spent carbon is regenerated with a loss of about 5 percent per cycle. The water is lifted 270 ft to a storage tank then about 1500 feet more to Indian Creek Reservoir where it is removed for use. (Ledbetter-Texas)
W70-01988

LABORATORY AND PILOT PLANT STUDIES ON PHOSPHATE REMOVAL FROM INDUSTRIAL WASTEWATER,
Hercules, Inc., Wilmington, Del.
Bruce W. Dickerson, and Philip J. Farrell.
J Water Pollut Contr Federation, Vol 41, No 1, p 56-62, Jan 1969. 2 fig, 7 tab, 5 ref.

Descriptors: *Phosphates, *Lime, *Industrial wastes, Pilot plants, Biochemical oxygen demand, Centrifugation, Dewatering.
Identifiers: *Alum, *Ferric sulfate, Lake Huron (Mich), Soda ash, Suspended solids, pH.

Laboratory and pilot plant tests were made to develop a treatment method for a wheat flour waste stream with 300 to 330 mg/l of phosphates and 5000 mg/l BOD. Lab studies showed that lime removed phosphate more efficiently than alum and ferric sulfate. Pilot plant studies showed that a 5 mg/l phosphate concentration is attainable at controlled pH. Centrifugation achieved 20 to 40% solids and appeared most practical. They did not claim this to be an economical process for phosphates removal. (Ledbetter-Texas)
W70-01989

PRIMARY TREATMENT OF POTATO PROCESSING WASTES WITH BYPRODUCT FEED RECOVERY,
Eimco Corp., Salt Lake City, Utah; and Simplot (J. R.) Co., Caldwell, Idaho.
Lloyd M. Grames, and Ray W. Kueneman.
J Water Pollut Contr Federation, Vol 41, No 7, p 1358-1367, July 1969. 2 fig, 3 tab, 2 ref.

Descriptors: *Foods, *Settling, *Design, Wastewater treatment, Cost Analysis.
Identifiers: *Primary treatment, *Snake River (Ida), Cattle feed, Vacuum filter, Population equivalent, Grease removal.

The results are reported of an investigation by an engineering committee which the Idaho Potato Processors Association formed to look into different methods of primary treatment to solve a pollution problem created by the operation of processing plants along the Snake River, Pilot-plant tests developed a primary treatment scheme including an optional grease-removal unit, potato waste clarifier, and belt-type vacuum filter. The authors report that the approach adopted by the potato processing industry in Idaho for the solution of the problem has been highly successful, that a primary treatment system with high efficiency has been produced; and that the facilities have resulted in the removal of waste from the waters of the state of Idaho equivalent to a population of more than three million. Dewatered sludge is sold profitably as cattle feed. (Ledbetter-Texas)
W70-01990

COMPUTATIONAL ANALYSIS OF TRANSIENT RESPONSE TO QUANTITATIVE SHOCK LOADINGS OF HETEROGENEOUS POPULATIONS IN CONTINUOUS CULTURE,
Oklahoma State Univ., Stillwater. Bioengineering Labs.
F. F. Storer, and A. F. Gaudy, Jr.
Environ Sci Technol, Vol 3, No 2, p 143-149, Feb 1969. 5 fig, 17 ref.

Descriptors: *Activated sludge, *Model studies, *Mathematical models, Carbon, Nutrients, Growth rates, Biological treatment.
Identifiers: *Shock loadings, *Chemostat, Glucose, Carbon source, Monod equation, Substrate, Cell yield, Continuous cultures, Heterogeneous populations, Heterogeneous cultures.

The Monod equation does not accurately predict the transient state biological solids and substrate concentrations subsequent to an increase in inflowing waste concentration. A chemostat was seeded from the primary clarifier of a sewage treatment plant and operated with synthetic medium. Carbon was furnished by glucose and was the growthlimiting nutrient. Shock loadings up to threefold were employed in six runs. The cell yield was calculated as the ration of the instantaneous rate of production of biological solids to the rate of COD utilization rather than the steady state procedure. A hysteresis was noted in the actual plot and the plot from the Monod equation. Future studies could well use a dual approach to mathematical analysis of biological growth of a heterogeneous population of microorganisms in aerobic conditions of transitional loadings. (Ledbetter-Texas)
W70-01991

CORROSION-RESISTANT COATINGS FOR WASTEWATER TREATMENT PLANTS,
Koppers Co., Inc., Pittsburg, Pa. Organic Materials Div.
A. F. Pistor.
Water Wastes Eng, Vol 6, No 5, p 52-53, May 1969. 1 fig, 1 tab.

Descriptors: *Protective coatings, *Paints, *Corrosion control, Epoxy resins, Coal tar coating.
Identifiers: *Corrosion resistance, *Concrete corrosion, Modified alkyds, Epoxy esters, Phenolic resins, Coal tar pitch, Coal tar epoxies, Chlorinated rubber, Vinyls.

Wastewater treatment facilities need to be constructed for corrosion control along with waste stabilization. Many places in waste treatment facilities are conducive to corrosion. Designs and construction can eliminate many of the causes of corrosion but protective coatings are needed on much of the equipment. The protective coating may be applied over a prime coat or the equipment may be sandblasted and coated in the field. The coatings in use include the following: oil modified alkyds, epoxy esters, phenolic resins, epoxy resins, coal tar pitch, coal tar epoxies, chlorinated rubber, and vinyls. The resistance characteristics are classified of these coatings and their application properties are given. (Ledbetter-Texas)
W70-01993

OIL WASTE DISPOSAL FACILITY STUDY, SEATTLE AREA,
Cornell, Howland, Hayes and Merryfield, Seattle, Wash.
William J. Edwards, and Norman C. Ward.
Municipality, Metropolitan Seattle, Engineering Report, Aug 1969. 51 p, 9 fig, 5 tab, 57 ref.

Descriptors: *Oil wastes, *Reclamation, *Treatment facilities, *Water pollution, *Water pollution control, *oily water, Oil, Pollution abatement, Sludge, Settling basins, Landfills, Sludge disposal, Costs, Incineration, Administration, Finance, Separation techniques, Design.
Identifiers: *Seattle, *Illegal dumping, Reuse, Barging wastes, Enforcement.

The engineering report presents the scope of the oil waste disposal problem, solutions thereto, dangers of contamination of underground and surface waters and details of design, operation, administration and finance of a recommended treatment facility for oil wastes. The study, financed by four public agencies in the Seattle area including the State, was initiated as the result of an illegal discharge of oil, in 1967, into the sewer system of the municipality of metropolitan Seattle. Oil wastes generated annually in the Greater Seattle area (Tacoma to Everett) total 9.3 million gallons. Principal sources are automotive, ship and tank cleaning, and industrial. Reclamation and reuse of the oil wastes, when feasible, is cited as the most desirable procedure to prevent pollution. Limitations of current disposal procedure are discussed--including landfilling, barging to sea, incineration and subsurface injection. The basic recommendation is that a local public agency construct and operate a central facility for disposing of oil wastes brought there by anyone. Total annual cost of the facility was estimated to be $105,000. A charge of 3.5 cents per gallon of wastes received is recommended to make the plant self-supporting. The suggested facility, when completed, would be unique. Federal demonstration grant funds are mentioned. Drawings, tables and bibliography are included. (Poertner-Chicago)
W70-02030

MULTISTAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
Deering Milliken Research Corp., Spartansburg, S.C.; and Clemson Univ., S.C., Dept. of Environmental Systems Engineering.
Eugene P. Willimon, Jr., and John F. Andrews.
J Water Pollut Contr Federation, Vol 41, No 1, p 99-112, Jan 1969. 12 fig, 1 tab, 18 ref.

Descriptors: *Anaerobic conditions, *Fermentation, *Anaerobic digestion, Septic tanks, Pilot plants, Microorganisms, Chemical oxygen demand, Phenols.
Identifiers: *Contact stabilization, pH, Volatile suspended solids, Multi-stage treatment, Continuous systems, Biomass, Coke oven wastes, Thiocyanates.

Use of multi-stage systems is examined in biological processes for anaerobic digestion. Exploratory studies on a two-stage anaerobic process involving pH control and limited aeration in the first stage are

presented. Improved chemical oxygen demand reductions were obtained using the two-stage process. The effects of pH, limited aeration, and retention time on product distribution are described. (Ledbetter-Texas)
W70-02042

5E. Ultimate Disposal of Wastes

SLUDGE DISPOSAL AND THE MARINE ENVIRONMENT,
Municipality of Metropolitan Seattle, Wash.
Ralph S. Domenowske, and Robert I. Matsuda.
J Water Pollut Contr Federation, Vol 41, No 9, p 1613-1624, September 1969, 12 p, 10 fig, 6 tab, 18 ref.

Descriptors: *Sludge disposal, *Marine bacteria, *Water quality control, *Waste treatment, *Benthos, Optimization, Biological properties, Biochemical oxygen demand, Computers, Regression analysis, Bacteria.

The study was conducted by the Municipality of Metropolitan Seattle to determine the minimum treatment and disposal costs required to meet the most stringent water quality standards of puget sound. The study also evaluated the biological and physical changes in the water and benthos which might have been the result of effluent or sludge disposal from the West Point treatment plant. Extensive tests and model studies were conducted prior to the construction of the outfall and predictions were made regarding the functionings of the system. One-way analysis of variance tests between station depth and outfall proximity for seven groups of benthic organisms were made. The analysis of variance, linear regression and computer plots of the chemical oxygen demand and bacterological and primary productivity data were collected and used in the biological analysis. Chemical oxygen demand values showed no significant difference in different strata. The bacteria count had decreased since the West Point Plant had gone into operation. (Thiuri-Cornell)
W70-01764

CHEBYSHEV OPTIMAL WASTE DISCHARGES,
Yale Univ., New Haven, Conn. Dept. of Administrative Sciences.
For primary bibliographic entry see Field 05D.
W70-01767

INCINERATION OF GRIT, SCREENINGS, AND SCUM.
Havens and Emerson, Cleveland, Ohio.

Report, Metropolitan Sanitary District, Greater Chicago, Feb 1969. 77 p, 11 tab, 6 fig, 2 append.

Descriptors: *Scum, *Sediments, *Sewage disposal, *Solid wastes, *Waste identification, *Wastewater disposal, *Incineration, Waste disposal, Wastes, Disposal, Costs, Air pollution, Heat balance, Sanitary engineering.
Identifiers: *Grit, *Sewage screenings, *Chicago, Sanitary district, Waste heat recovery, Material handling, Wastewater treatment and plant design.

Detailed studies and a preliminary design of an incineration system for the disposal of grit, screenings, and scum from all of the wastewater treatment plants of the Metropolitan Sanitary District of Greater Chicago are reported by a firm of consulting engineers. The study included: (1) determination of quantities and characteristics of the waste materials; (2) material handling problems; (3) incineration processes; and (4) design, layout, and cost estimates of the proposed system. The report proposes the construction of an incinerator at the District's Southwest Treatment Works capable of handling 250 tons (wet) daily. Containerized truck hauling of grit, screenings, and scum from outlying District treatment plants to the Southwest plant is recommended, based upon cost comparisons with other methods. An incinerator proposed is a 7-hearth furnace designed to meet anticipated air pollution regulations and estimated load requirements in the year 1985. A waste-heat recovery system is considered feasible and is recommended (optional) for space heating, material thawing, and for use in the plant's power house. Construction costs (1970) are estimated at $2,631,000, and annual operating and maintenance costs, $138,600. (Poertner-Chicago)
W70-02029

OIL WASTE DISPOSAL FACILITY STUDY, SEATTLE AREA,
Cornell, Howland, Hayes and Merryfield, Seattle, Wash.
For primary bibliographic entry see Field 05D.
W70-02030

DISPOSAL OF DIGESTED SLUDGE TO PUGET SOUND--THE ENGINEERING AND WATER QUALITY ASPECTS/July, 1965.
Municipality of Metropolitan Seattle, Wash.

Municipality of Metropolitan Seattle, King County, Washington, July 1965. 75 p, 9 photos, 36 fig, 21 tab, 177 ref, 6 append.

Descriptors: *Sewage sludge disposal, *Sludge disposal, *Sewage disposal, *Oceanography, Sludge treatment, Water quality control, Anaerobic digestion, Monitoring, Costs, Beds under water, Sludge worms, Waste disposal, Chlorination, Hydarulic conduits, Hydraulic design.
Identifiers: *Puget Sound, *Seattle, Municipality of Metropolitan Seattle, Dilution of sludge, Submarine sludge outfall sewer, Ocean disposal of sewage sludge, Outfall diffuser.

The disposal of digested sludge from the West Point and Renton wastewater treatment plants serving Metropolitan Seattle by dilution in the waters of Puget Sound is recommended. The Municipality's staff and consultants agree that the quality of the receiving water can be suitably maintained for other beneficial uses and that the public health and welfare will be protected. A comprehensive water quality monitoring program is being established. The digested sludge would be screened to remove objectionable floatable materials, mixed with effluent from the primary treatment plant, and chlorinated prior to disposal into the Sound through a 96 inch diameter submerged outfall sewer. Jet mixing with sea water by a diffuser in the sewer will produce a dilution of more than 10,000 to one upon discharge. Ultimate disappearance of the sludge will result from combined effects of further volatization, hydrodynamic dispersion, sedimentation and flushing to the ocean. Little buildup of digested sludge solids on the bottom of the Sound is predicted. The sludge disposal method proposed is believed to be the most practical and economical of various alternatives considered. Similar sludge disposal methods are practiced successfully at Los Angeles. (Poertner-Chicago)
W70-02031

5F. Water Treatment and Quality Alteration

PESTICIDES IN DRINKING WATER: WATERS FROM THE MISSISSIPPI AND MISSOURI RIVERS,
Consumer Protection and Environmental Health Service, Cincinnati, Ohio.
M. L. Schafer, J. T. Peeler, W. S. Gardner, and J. E. Campbell.
Environ Sci and Technol, Vol 3, No 12, p 1261-1269, Dec 1969. 9 p, 1 fig, 8 tab, 6 ref.

Descriptors: *Pesticide residues, *Potable water, *Mississippi River, *Missouri River, DDT, Dieldrin, Endrin, Aldrin, Heptachlor, Water pollution sources, Sampling, Municipal water, Water supply, Water analysis.
Identifiers: Drinking water, DDE, HCE.

Over 500 grab samples of finished drinking water and related raw water were assayed for 10 organochlorine pesticides, their metabolites, and related compounds. The samples were collected between March 1964 and June 1967 from 10 selected municipal finished water supplies whose source was either the Mississippi or the Missouri River. Both 100-ml and 1-gallon sample sizes were assayed. Included is a statistical evaluation of the one-step extraction method using 1-gallon samples to which known amounts of the 14 compounds were added to levels ranging from 0.06 to 5.0 ppb. Over 40% of the finished water samples contained detectable dieldrin and more than 30% contained detectable endrin, DDT, and DDE. Twenty per cent of the 63 samples assayed for chlordan contained detectable concentrations; five of these were in excess of 0.25 ppb. Aldrin, HCE, and heptachlor were found only occasionally. No toxaphene nor methoxychlor was detected. (Knapp-USGS)
W70-01643

PERFORMANCE OF POROUS CELLULOSE ACETATE MEMBRANES FOR THE REVERSE OSMOSIS TREATMENT OF HARD AND WASTE WATERS,
Ottawa Pollution Control Center (Ontario); and National Research Council of Canada, Ottawa (Ontario). Div. of Applied Chemistry.
For primary bibliographic entry see Field 05D.
W70-01644

SURVIVAL OF ADULT DREISSENA IN COPPER SULFATE SOLUTIONS OF DIFFERENT CONCENTRATION AND TEMPERATURE,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
V. S. Lukanin.
Translated from Trudy Instituta Biologii Vnutrennikh Vod, No 7 (10), 1964. Biology and Control of Dreissena, Jerusalem, Israel Program for Scientific Translations, 1968, p 69-70.

Descriptors: *Copper sulfate, *Molluscasides, Mollusks, Water supply.
Identifiers: *Dreissena.

Lethal doses of copper sulfate for adult Dreissena with 5 hours exposure were experimentally determined at 11 concentrations ranging from 0.0 mg/l to 24,300 mg/l and at 5 temperatures ranging from 12.5 deg C to 32.5 deg C. At temperatures below 22.5 deg C the lethal doses of copper sulfate are unpractically high. Exposure to 32.5 deg C for 5 hours in pure water resulted in 100% mortality. (Tyner-Washington)
W70-01791

THE EFFECT OF CERTAIN METAL IONS ON DREISSENA,
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
V. F. Dudnikov, and V. P. Mikheev.
Translated from Trudy Instituta Biologii Vnutrennikh Vod, No 7 (10), 1964. Biology and Control of Dreissena, Jerusalem, Israel Program for Scientific Translations, 1968, p 60-64.

Descriptors: *Electrolysis, *Molluscasides, Ions, Mollusks, Pesticides, Pipelines.
Identifiers: *Dreissena, *Copper ions, *Silver ions, Lead ions, Mercury ions, Zinc ions.

One method for the elimination of Dreissena overgrowth in pipelines is the use of electrolytically dissolved metal ions. Silver, copper, mercury, zinc and lead were tested for their molluscasidal effect. Copper is the most effective (100% mortality in 24 hours at 4 mg/l). Larger mollusks die sooner than small ones. Dreissena perish sooner at water temperature optimal for their development. (Tyner-Washington)
W70-01792

FLOW THROUGH POROUS MEDIA: A STATISTICAL APPROACH,
Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
For primary bibliographic entry see Field 03A.
W70-01886

AERATION OF WAHNBACH RESERVOIR WITHOUT CHANGING THE TEMPERATURE PROFILE,
Wahnbachtalsperenverband, Siegburg (West Germany).
Heinz Bernhardt.
J Amer Water Works Ass, 5918, p 943-64, 1967.

Descriptors: *Temperature, *Thermal stratification, *Aeration, Manganese, Reservoirs, Impoundments, Stability, Hypolimnion, Fish, Plankton, Oxygenation, Economic efficiency, Phosphorus.
Identifiers: Artificial aeration.

Aeration and mixing of a 33,740 acre impoundment was found to be technically and economically feasible either by destratification by using the diffused air bubble method or by aeration of the hypolimnion only. Cold water for drinking was preserved by hypolimnion aeration inasmuch as destratification did not occur. O2 was maintained>0 in the hypolimnion and Mn++ concentrations were near 0. Mixing reduced the population of the algae Oscillatoria rubescens. The influence of destratification on the movement of phosphorus to the surface of the reservoir could not be determined, but eutrophic processes were not increased as no additional plankton occurred in the reservoir after mixing. The oxygen transfer, oxygenation capacity, and destratification efficiency of the devices described in this paper compare favorably with other aeration devices reported in the literature. (Novotny-Vanderbilt)
W70-01929

5G. Water Quality Control

SYSTEMS ANALYSIS FOR OPTIMAL WATER QUALITY MANAGEMENT,
Federal Water Pollution Control Administration, Edison, N.J.
For primary bibliographic entry see Field 05B.
W70-01766

COMBINED UNDERFLOW-STORAGE PLAN FOR POLLUTION AND FLOOD CONTROL IN THE CHICAGO METROPOLITAN AREA.
Department of Public Works, Chicago, Ill. Bureau of Engineering.

City of Chicago Dep Public Works, Bur Eng Rep, Sept 1969. 43 p, 13 exhibit, 6 tab.

Descriptors: *Storm runoff, *Waste water treatment, *Water pollution control, *Tunnels, *Illinois, Urbanization, Sewers, Sewage treatment, Drainage systems, Storm drains.
Identifiers: Combined sewer systems, Chicago Underflow-Storage Plan.

The basic concept of the Chicago Underflow-Storage Plan for Pollution and Flood Control is the use of a pattern of underground tunnels, sized so as to provide a rational and economical fusion and linear distribution of storage volume and conveyance capacity in a single pattern of cleansable tunnels, without the necessity for supplemental storage in caverns or quarries, without power development. All water remaining in the underground tunnels after each storm period will be pumped directly to the existing treatment works. The underflow-conveyance capacity takes advantage of the lowered water levels to be established in the Illinois Waterway at Lockport for flood control and improved navigation. The basic features of the Underflow-Storage Plan include: (1) 18,000 acre-feet of underground storage; (2) A combined outflow capacity by underflow and overflow of about 43,000 cfs; (3) Sufficient underground storage for any storm having a frequency of recurrence up to 100 years. The total capital cost of the proposed Combined Underflow-Storage Plan is estimated to be $650,000,000. (Knapp-USGS)
W70-01869

HOW TO BEAT THE HEAT IN COOLING WATER,
Sargent and Lundy, Chicago, Ill.
T. D. Kolflat.
Electrical World, Vol 170, No 16, p 31-33, Oct 14, 1968. 6 fig.

Descriptors: *Temperature, *Cooling towers, Cost comparisons, Reservoirs, Thermal pollution, Water cooling.
Identifiers: Spray-header cooling.

One method proposed for holding down the heating effect is to dissipate it to a greater volume of water. For example the heat discharged from a 1000 Mw plant will add 30F to a 1000 cfs flow, 3F to 10,000 cfs flow and 0.3F to 100,000 cfs. Another approach is to select the optimum condenser rise independent of dilution considerations and dilute the water after it leaves the condenser. In many areas the natural rolling topography lends itself to building reservoirs for cooling water which can provide recreational benefits also. A cooling tower attempts to accelerate the natural cooling process. Cooling-tower performance is a function of range and approach. In general, the mechanical-draft wet-type tower will have an optimum range of 21F and an approach of 18F, the natural-draft wet-type a range of 26F and an approach of 18F, the mechanical dry-type a range of 12F and an approach of 33F and natural-draft dry-type a range of 17F and an approach of 38F. (Upadhyaya-Vanderbilt)
W70-01915

SECONDARY EFFLUENT DEOXYGENATION AT DIFFERENT TEMPERATURES,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W70-01921

COOLING-WATER DEBATE NEEDS CLARIFICATION,
Sargent and Lundy, Chicago, Ill.
T. D. Kolflat.
Electrical World, Vol 170, No 8, p 25-27, Aug 19, 1968. 6 fig.

Descriptors: *Temperature, *Thermal pollution, Fish, Thermal power.

The quantity of heat added to the cooling tower is essentially equal to that exhausted from the turbine. This exhaust heat can be reduced by modifying the basic thermal cycle. Each 100-psi increase in pressure of steam entering the turbine will decrease waste heat 0.4%. If the steam generated in the boiler is passed through a superheater the heat rejection will be reduced by about 1.4% for each 50F added. Another method of reducing heat from the turbine exhaust is to extract a portion of the steam from various points in the turbine and use it to heat water entering the boiler. This can reduce heat rejection up to 37%. There seems to be sufficient evidence to seriously question 93F as a water limit. Many plants have discharged water to rivers at 105F in summer with no adverse effect on aquatic life; fish have been caught alive in 105F water. Fish acclimatize to higher temperatures and migrate to and from areas not to their liking. Tolerance levels vary with different species and dissolved oxygen is above the minimum for fish at temperatures as high as 105 deg F. (Upadhyaya-Vanderbilt)
W70-01924

DIFFUSER DESIGN FOR DISCHARGE TO A STRATIFIED WATER,
Danish Isotope Center, Copenhagen.
P. Harremoes.
Water Research, Vol 2, p 737-752, Nov 1968. 12 fig, 20 ref.

Descriptors: *Stratified flow, *Sewage disposal, *Jets, Density stratification, Tracers, Design criteria.
Identifiers: *Stratified dispersion, Bacterial decay.

Results from several tracer experiments with submerged sewage fields in long-shore currents having pronounced stratification are used as a basis for the economical optimization of a discharge of domestic sewage through a diffuser. Existing theories on jet diffusion have been modified to fit the observed conditions, which have almost arbitrarily varying density distributions. A first approximation to dispersion in stratified flow is applied with data derived from tracer experiments. Bacterial decay is disregarded due to the very slow decay rates previously observed in The Sound, which is the strait between Denmark and Sweden. The computation of jet diffusion and stratified dispersion is computerized to meet the demand for a statistical prediction of pollution and for selecting the most economical design among the infinite number of possible outfall designs. Density effects on the sewage field are suggested to be of significance to design criteria for diffusers. (Rietveld-Vanderbilt)
W70-01928

AERATION OF WAHNBACH RESERVOIR WITHOUT CHANGING THE TEMPERATURE PROFILE,
Wahnbachtalsperenverband, Siegburg (West Germany).
For primary bibliographic entry see Field 05F.
W70-01929

AQUATIC WEED CONTROL WITH SODIUM ARSENITE,
Wisconsin State Board of Health, Madison. Committee on Water Pollution.
Kenneth M. Mackenthun.
Sewage and Industrial Wastes, Vol 22, No 8, p 1062-1067, Aug 1950. 20 ref.

Descriptors: *Aquatic weed control, *Sodium arsenite, Fish, Wisconsin, Lakes, Shores, Pondweeds, Chara, Copper sulfate, Bass, Eutrophication, Water pollution effects, Water pollution control, Water quality control, Herbicides.
Identifiers: Arrowhead, Water plantain, Bladderwort, Coontail, Waterweed, Wild cherry, Water crowfoot, Water milfoil, Bluegills, Crappies, Common pondweed, Bushy pondweed, Chemical weed control, Wisconsin Committee on Water Pollution, Horned pondweed.

Commercial sodium arsenite has been effectively used in the destruction of certain species of aquatic vegetation and the eradication of localized nuisances without harm to fish life. In Wisconsin its use has been authorized and supervised by an interdepartmental state committee for the past 10 years. Dosages up to 10 parts per million are recommended, depending on the physical character of the area to be treated. The time necessary for weed destruction after application of the chemical is usually about seven days. Treatment should be initiated when weeds are young and growing vigorously, so that a maximum amount of chemical will be absorbed by plant cells. Following destruction, weeds sink to the bottom and remain in place in the bottom muds. This procedure reduces the possibility of oxygen depletion caused by the decomposition of large masses of plant tissue. Decomposition rates are usually so slow that the oxygen balance is not greatly distorted. A history of the development of the program in Wisconsin is given in detail, as well as the method of application and the effect of such application on aquatic vegetation and aquatic organisms. (Jones-Wisconsin)
W70-01939

WATER POLLUTION CONTROL.

R I Gen Laws Ann secs 46-12-2, 46-12-3 (Supp 1968).

Descriptors: *Rhode Island, *Water pollution control, *Public health, *Pollution abatement, Abatement, Water pollution effects, Disposal, Environmental engineering, Legislation, Legal aspects, Wastes, Pollutants, Water polution sources, Water pollution treatment, Project planning, Planning, Surveys, Investigations, Administrative agencies, Federal government, Water quality, Supervisory control (Power).

The Director of the Department of Health is responsible for carrying out the state's water pollution control legislation. He may consult the Advisory Board of Water Pollution regarding policies and plans for control and abatement of pollution. The Department of Health is designated as the state's water pollution control agency for purposes of obtaining federal assistance under the federal Water Pollution Control Act. In addition to exercising general supervisions of the administration of the pollution law, the Director shall: (1) develop programs for prevention and abatement of new and existing pollution; (2) cooperated with federal and state agencies in planning or securing financial assistance; (3) conduct investigations and disseminate information concerning water pollution and its control and prevention; (4) modify or adopt standards of water quality; (5) administer state grants to political subdivisions for construction of sewer treatment works; (6) supervise construction of disposal systems; and (7) issue reasonable rules and regulations for the prevention, control, and abatement of pollution and enforcement of orders thereunder. (Kelly-Florida)
W70-02002

WATER QUALITY MANAGEMENT BY REGIONAL AUTHORITIES IN THE RUHR AREA,
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese.
Controlling Pollution, Englewood Cliffs, N J, Prentice Hall, p 109-129, 1967. 21 p.

Descriptors: *Water quality management, *Water pollution, Economics, Regional analysis, Municipal wastes, Industrial wastes, Government, Watersheds, Rivers, Planning, Costs, Waste treatment, Taxes, Welfare economics, Effluents, Marginal costs, Prices, Flood control, Water supply, Water resources.
Identifiers: *Ruhr River, Social costs.

In this article the author describes how pollution has been successfully checked by a method which combines regional cooperation and management with a system of economic charges to polluters. A review of the background and concepts underlying water quality management in the United States is provided with the conclusion that achieving clean streams will involve public investment far higher than in any other field of resources development or conservation. This provides the framework for discussion of the German experience. The cost assessment procedures and effluent charges are outlined. Generally, it is found that economic incentives have been used successfully to control the pollution of manufactures and municipalities. The article concludes, however, with a discussion of some of the difficulties and deficiencies in this method of pollution control. (Murphy-Rutgers)
W70-02004

EFFLUENTS AND AFFLUENCE,
Federal Reserve Bank of Boston, Mass.
Jared E. Hazelton.
New England Business Review, p 2-9, June 1965. 8 p.

Descriptors: *Regional analysis, *Water pollution, Rivers, Streams, Costs, Benefits, Waste disposal, Water resources development, Municipal wastes, Industrial wastes, Recreation, State government, Federal government, Flood control, Planning.
Identifiers: *Zoning, *Classification of rivers, Scenic value.

This article describes the zoning approach used by the New England Interstate Water Pollution Control Compact. This regional authority classifies sections of rivers and streams according to a scale of potential water uses, balancing the costs of treatment and dumping restrictions against the benefits that various kinds of water use bring to the community. An attempt is made to estimate the progress in water pollution control through the increased number of treatment plants constructed. The role of the federal and state governments is reviewed. The article concludes with some recommendations for necessary changes in the area. (Murphy-Rutgers)
W70-02012

OIL DISPERSING CHEMICALS, A STUDY OF THE COMPOSITION, PROPERTIES AND USE OF CHEMICALS FOR DISPERSING OIL SPILLS,
Federal Water Pollution Control Administration, Edison, N.J. Water Quality Lab.
Melvin Z. Poliakoff.
Available from Clearinghouse as PB-188 207 $3.00 in paper copy, 0.65 in microfiche. FWPCA Water Pollution Control Research Series, ORD-3, May 1969. 27 p, 23 ref. FWPCA Program Number 15080FHS 05/69.

Descriptors: *Dispersion, *Emulsifiers, *Water pollution control, *Reviews, Chemical analysis, Chemicals, Detergents, Oil, Surfactants, Testing, Emulsions.
Identifiers: *Oil spillage.

A 'state-of-the-art' review is provided for chemicals which are used for dispersing spilled oil. Among the topics discussed are: the history of the development of oil spill dispersants; basic emulsion chemistry, including the nature and properties of surface active agents; chemical composition of oil spill dispersants, including a description of generic chemical types; production of dispersants, properties of dispersants; chemical analysis of oil spill dispersants; and the measurement of oil spill dispersing power.
W70-02037

A MODEL FOR QUANTIFYING FLOW AUGMENTATION BENEFITS,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
E. E. Pyatt, J. P. Heaney, G. R. Grantham, and B. J. Carter.
Available from the Clearinghouse as PB-188 208 $3.00 in paper copy, 0.65 in microfiche. Final Report to Federal Water Pollution Control Administration, USDI, Southeast Region, Atlanta, Ga, Sep 1969. 630 p, 52 tab, 58 fig, 184 ref, 5 append. FWPCA Grant No 16090 DRM.

Descriptors: *Systems analysis, *Benefit - cost analysis, *Flow augmentation, Water quality control, River basins, Reservoirs and impoundments.

With increasing quantitative and qualitative demands being placed upon national water resources, improved management practices are vitally needed. In principle, one powerful management tool is systems analysis, wherein mathematical optimizing techniques are employed to effect rational tradeoffs between competing demands for water use, but this tool, in turn, rests upon the availability of methodologies for quantifying the benefits (economic value) of each water-use category. That is, systems analysis, before it can be employed comprehensively, demands a knowledge of the functional value of irrigation, flood control, municipal water supply, etc. Little is known of the economic implications of low flow augmentation, one of the important water-use categories. Beginning with the premise that the value of low flow augmentation is measured by sewage treatment costs avoided, a hydrologic flow simulator and a water quality linear programming model were interfaced to develop a procedure for determining 'willingness to pay' for augmentation. This generalized approach can be applied by others to their specific water pollution control situations.
W70-02039

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

CRITICAL PATH METHOD OF WORK SCHEDULING,
Department of Water and Power, Los Angeles, Calif.
Robert U. Olson.
J Amer Water Works Ass, Vol 61, No. 9, p 447-454, September 1969. 8 p, 12 fig, 2 ref.

Descriptors: *Critical path method, *Scheduling, *Resource allocation, *Network design, *Simulation, Computers, Project allocation, Control systems construction costs, Construction materials.
Identifiers: Early start time, Late start time.

The step-by-step procedure for the development of a critical path method (CPM) was given. The objective of the study was to demonstrate by a construction project example the step-by-step organization and use of the critical path method of scheduling. Thirteen steps were outlined. The steps ranged from the listing of all activities that were required to be performed for the completion of the project to maintaining project control by instituting a regular reporting system. The early start time (EST) and the late start time (LST) were calculated and a critical path determined. The critical path was the longest time path through the network, and was indicative of the time it would take to complete the job. The critical path had two main characteristics, (a) it passed through all events were EST and LST were the same, (b) it was continuous from the start of the project to the end. The use of a computer to simulate CPM network diagrams was recommended. It was concluded that CPM would indicate the most practical way accelerate completion of the project, and in the scheduling of material delivery, provide information on the effects of changes and allow for a more effective utilization of resources. (Thiuri-Cornell)
W70-01765

PAPER (TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY) (IN FRENCH),
Antoni Arkuszewski, and Todeusz Wierzbicki.
In: Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Paper Sect 1, Subj 4, p 117-127, 1969. 11 p, 2 tab.

Descriptors: *Navigable rivers, Concrete-lined canals, Optimum development plans, *Inland waterways.
Identifiers: *Traffic capacity, Canalized rivers.

Particular sectors of waterways in Poland have various gauges, which influence the traffic capacity. The free-flowing rivers have large traffic capacities. The capacity of locks are not as great and depends on the speed of opening and closing, and of filling and emptying of locks. Also, the speed of ships coming in and going out of the locks is an important factor. For each waterway the optimum size of ships which allow for the maximum capacity of the waterway may be determined. An example of the optimization of traffic capacity of the Odra is included. In order to increase the traffic capacity of waterways the following conclusions are suggested: unify the gauges of channels and its conditions of navigation; unify the size of ships, as far as possible; the locks should be equipped with protective installations, the locks should be well lighted for day and night use; the capacity of ports should be greater than the capacity of waterways. The article is written in French and includes an English summary. (Grossman-Rutgers)

W70-01843

REGIONAL ECONOMICS,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 06B.
W70-02018

FORECASTING WITH ECONOMETRIC MODELS: AN EVALUATION,
State Univ. of New York, Stony Brook.
For primary bibliographic entry see Field 06B.
W70-02024

A MODEL FOR QUANTIFYING FLOW AUGMENTATION BENEFITS,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05G.
W70-02039

6B. Evaluation Process

WATER AND LAND RESOURCES OF ARKANSAS,
Arkansas Soil and Water Conservation Commission, Little Rock.
For primary bibliographic entry see Field 10.
W70-01701

DEVELOPMENT PROBLEMS IN ARID ZONES,
Raymond Furon.
IN The Problem of Water: A World Study, New York American Elsevier, p 135-162, 1967.

Descriptors: *Arid lands, *Land reclamation, *Arable land, *Climatology, *Semiarid climates, Irrigable land, Dendrochronology, Human resources, Land resources, Water resources, Economics, Deserts, Population, Permafrost.
Identifiers: *Israel, *Greece, *Algeria, *Sahara, Egypt, Nile River, Fossil water.

Arid lands of the world might be brought under cultivation to meet the need for food by an expanding world population. Large uncultivated areas of the world are listed. Much of these regions is unsuitable mountain country, frozen waste or true desert without accessible water. Many semiarid lands have once been cultivated and might be again if economically sound means were devised to deliver irrigation water. Over the long run reclamation plans should consider dependability of water supply in view of long term weather cycles. The author identifies 'false deserts' as areas with a dependable source of water which have become unproductive through neglect or misuse and resulting erosion. Greece and Israel are examples that are being reclaimed through careful planning and management. The author emphasizes and gives examples of the need for careful planning, thorough physical and human resource surveys and sound management in successful arid land reclamation. (Crouse-Arizona)
W70-01805

COST-BENEFIT ANALYSIS OF PASTURE IMPROVEMENT IN THE ARID REGION OF RAJASTHAN,
Agro-Economic Research Centre, Vallabh Vidyanagar (India).
For primary bibliographic entry see Field 03F.
W70-01809

PROJECTIONS OF NET INCOME AND WATER USE IN PINAL COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 04B.
W70-01812

THE GEOGRAPHICAL BACKGROUND OF THE JORDAN WATER DISPUTE,
Moshe Brawer.
In: C A Fisher, ed, Essays in Political Geography, 1968, London, Methuen, p 225-242. 2 maps, 10 ref.

Descriptors: *Arid lands, *Irrigation programs, *Pumping, *Water resources development, *Political aspects, Water quality, Chlorine, Costs, Rivers, Water shortage, Institutional constraints, Foreign countries.
Identifiers: *Israel, *Jordan River, *Jordan, Sea of Galilee, Syria, Political Geography.

The author reviews the geographical and historical background of the Jordan water dispute. Well over half of Israel has an average rainfall of less than 8 inches. Israel has already developed virtually all of the fresh water resources under its control. If further agricultural and economic growth is to proceed, Israel must draw on large quantities of Jordan River water. Such development is disputed by the Kingdom of Jordan and by Syria, through which the head waters of the Jordan run. Syria has successfully blocked the originally planned diversion project for Jacob's Daughter's Bridge, from which water would have flowed by gravity to the western deserts of Israel. Instead, water is lifted by costly pumping from the Sea of Galilee, which is within Israel's geographic boundaries. Substantial savings in evaporative losses are realized, however. Far more efficient use of the Jordan's waters could be affected by cooperative development by all the nations concerned rather than by individual national development schemes. (Crouse-Arizona)
W70-01833

REGIONAL CONSIDERATION OF FLOOD PLAIN PLANNING,
Bi-State Metropolitan Planning Commission for Scott County, Iowa and Rock Island County, Ill.
William S. Luhman.
In: Flood Plain Management, Iowa's Experience, Iowa State University Press, Ames, Iowa, p 93-102, 1969. 1 fig, 10 ref.

Descriptors: *Planning, *Coordination, *Regions, Flood plains, Regional analysis, Local governments, Management, Iowa, Land use.
Identifiers: Scott County, Iowa, Bi-State Metropolitan Planning Commission.

This article focuses on the development of effective regional planning programs which relate to flood plain management. The existing pluralistic local government system cannot deal effectively with regional problems. Therefore, there is a need for some sort of regional cooperative planning for the continued growth and development of these urban regions. The Federal government has recognized this problem and several acts have been passed requiring regional coordination in application for grants. Local elected officials are also giving recognition to the necessity of individual local governments joining together in solving their related and frequently interdependent urban problems. Identification of goals and objectives, the need for cooperative regional planning, the preparation of a regional land-use plan and problems of effectuating a regional plan are discussed. A specific example of the Bi-State Metropolitan Planning Area in Scott County, Iowa and Rock Island, Illinois, is used to illustrate problems of coordination in regional planning. The conclusion reached is that it is futile to attempt regional planning without similar programs in operation along the length of the river, based upon a total river basin program. The real contribution the regional approach makes is to begin coordinating the many local jurisdictions within each of the respective regions along the river. (Marriott-Chicago)
W70-01837

TECHNIQUES FOR DEVELOPING A COMPREHENSIVE PROGRAM FOR FLOOD PLAIN MANAGEMENT,
Iowa State Univ., Ames.
Merwin D. Dougal.
In: Flood Plain Management: Iowa's Experience (Iowa State University Press, Ames, Iowa 1969), p 53-75. 7 fig, 32 ref.

Descriptors: *Flood control, *Water management (Applied), Flood forecasting, Flood damage, Flood protection, Water control, Iowa.
Identifiers: *Flood plain management.

The steps required to implement an action program for a flood plain management program are outlined. An action program provides for recognition of the flood hazard, flood forecasting, flood fighting emergency measures, short-range plans for alleviating flood damages, and long-range plans to accomplish the wise use of flood plain areas. The indirect and direct methods of reducing flood damages through control of floodwaters are reviewed in some detail. Flood forecasting and warning systems can be implemented swiftly at little cost to the community. Flood fighting and emergency protection measures can assist in reducing flood losses. Engineering works for flood control provide additional measures for direct and effective control of flood water and permit substantial reductions of flood losses where they are economically feasible. In conclusion, the author states that although the implications for funding, organization, and personnel appear great if all these endeavors are to be accomplished in a modicum of time, existing agencies can be used at the federal level and in most states. A reorientation or strengthening of activities is a major requirement at several levels of government, but mainly at the state and local levels. Each of these measures should be considered a part of the total flood plain management program for a river basin or for acceptance by a state government. (Marriott-Chicago)
W70-01838

MAN SHOULD MANAGE THE FLOOD PLAINS,
James E. Goddard.
In: Flood Plain Management: Iowa's Experience, ed by Merwin D Dougal (Iowa State University Press, 1969), p 11-21. 7 ref.

Descriptors: *Flood plains, *Management, Political aspects, Adoption of practices, Flood control, Flood plain zoning, Multiple-purpose projects.
Identifiers: *Flood plain management.

The article includes basic discussion of the meaning of flood plain management, a review of the historic role of flood plain utilization and attendant flood damages, and enlarges upon the need for comprehensive and broad approaches to management. Broader programs now being developed are discussed and it is pointed out that success in flood plain management depends upon cooperation between all agencies and levels of government. Recommendations for more effective action given in some detail are briefly: (1) Improve public relation and programs for informing the public so there will be necessary support for action programs; (2) arrange state conferences directed toward developing better understanding of the respective federal, state, and local roles and of their relationship in flood plain management; (3) accelerate the effort of the federal government; (4) enlarge the roles of the states and encourage term to accept greater responsibility in programs to assist their citizens; and (5) increase the role of local governments (city, county, and regional) and their acceptance of greater responsibility. (Marriott-Chicago)
W70-01839

METROPOLITAN WATER RESOURCE MANAGEMENT AS AN EMERGING SPECIALIZED TECHNICAL AREA: A STATE-OF-THE-ART AND LITERATURE REVIEW,
Chicago Univ., Ill. Center for Urban Studies.
John R. Sheaffer, Shirley A. Starr, George Davis, and Alan Richmond.
Available from the Center for Urban Studies, University of Chicago, for $3.00 per copy. Center for Urban Studies, University of Chicago, 1969. OWRR Project W-107. 124 p, 4 fig, 7 tab, 5 append, 1 plate.

Descriptors: *Water resources development, *Project planning, Research and development, Regional analysis, Decision making, Federal project policy.
Identifiers: *Metropolitan water resource management, *Regional integration.

The primary objective of this study is to increase understanding of the present status of the rapidly evolving and potentially beneficial metropolitan water resource management strategy. Through a selective literature search and analysis of materials being produced on metropolitan water resource management, and through a systematic analysis and comparison of theoretical statements and statements made by urban water managers, an interest area has been delineated. The results of this study identify the progress that has been made and the agreement which has been reached. Identified also are the critical research needs and the deficiencies which exist in present metropolitan water resource management efforts.
W70-01840

PAPER: (NAVIGABLE WATERWAYS BANK PROTECTION) (in French),
Behorde fuer Wirtschaft und Verkehr, Hamburg (West Germany).
Kurt Feuerhake, Rudolf Hintze, Werner Hoffmann, Heinrich Meyer, and Hand Theodor Schroder.
In: Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr Paper, Sect 1, Sub. 6, Inland Navigation, p 5-36, Paris, 1969. 29 fig.

Descriptors: *Retaining walls, *Canal design, Navigable waters, Transportation, *Inland waterways.
Identifiers: *Main-Danube canal, *North Sea-Baltic Sea canal.

The importance of stresses due to traffic on the behavior of bank revetments is stressed. It is necessary to ascertain the forces to which these structures are submitted through full-scale and laboratory tests. The Main-Danube canal in the Bamberg reach was selected for testing inland navigation. For the testing of ocean navigation the North Sea-Baltic Sea Canal was chosen. The bank revetment must be designed to safely absorb the energy developed furing the passage of vessels. The design and the choice of the revetment also depends on materials available and their cost, on conditions of construction on estimated duration of the revetment, and on maintenance costs. The paper is written in French and contains a summary written in English. (Grossman-Rutgers).
W70-01841

PAPER: (NAVIGABLE WATERWAY BANK PROTECTION) (IN FRENCH),
Ghent Rijksuniversiteit (Belgium).
Marcel Van Cauwenberge, and Paul Lagrou.
IN: perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Paper Sect 1, Subj 6, p 37-48, Paris, 1969. 7 p, 4 fig.

Descriptors: *Retaining walls, *Canal design, Erosion control, Plastics, *Inland waterways.
Identifiers: Ghent-Burges Canal.

Two examples of slope consolidation are presented: (1) Bank consolidation by means of rubble-filled gabions and (2) Temporary bank consolidation along the Ghent-Burges Canal consisting of a double row of polyethylene perforated plates. These plates must resist air, acid, base, salt and frost effects. The use of polyethylene sheets was the most economical alternative available. The article is written in French and contains an English summary. (Grossman-Rutgers)
W70-01842

PAPER: (TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY),
Buenos Aires Univ. (Argentina).
R. A. Frederico Prestein.
In: Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Paper Sect 1, Subj 4, p 21-34, 1969. 14 p, 5 maps.

Descriptors: *Navigable rivers, *River systems, Mississippi River, Maintenance costs, Investment, *Inland waterways.

The problems of developing and operating waterways in a country which is itself undergoing development, are set out. A general account of the economy of waterway transport is made. The navigable waterways of Argentina are the Plata, Parana, Paraguay and Uruguay. The size of the river fleet is examined. Navigation conditions on the Parana are compared with those on the Mississippi. The numerous river ports should be either abandoned where there is little traffic or should be industrially developed. The author distinguishes between the infrastructure of the waterway itself (channels, navigable passes, signalling) and stationary installations connected with the waterway (river ports, shore terminals, handling and storage equipment); ships and boats using the waterway in question, a difference being made between ocean-going ships and river boats. Increasing the natural depth of rivers means not only investments but also increased maintenance costs. However, increased tonnage may reduce freight charges. The article is written in English and contains a resume written in French. (Grossman-Rutgers)
W70-01844

PAPER: (TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY) (IN FRENCH),
Bundesverkehrsministerium, Bonn (West Germany).
Dr. Gerhard Wiedemann, Burkart Rumelin, Emil Renner, Werner Behle, and Joachim Michael.
In: Perma Int Asso of Navigation Congr XXIInd Int Navigation Congr, Paper Sect 1, Subj 4, Paris, p 5-20, 1969. 16 p, 2 tab, 1 fig, 5 ref.

Descriptors: *Inland waterways, Psychological aspects.
Identifiers: *Transport capacity, *Traffic density.

Influencing factors and a technique for determining the transport capacity of a waterway section without locks are discussed. The traffic flow of a waterway is affected by the human factor, the actions of ship navigators, as well as the dimensions of the ships and the waterway. This human influence can be quantified by distinguishing various categories in the traffic flow which depend on the traffic density. Determination is possible for typical cases of movement, which govern the categories. Relative traffic densities are established for the main movement cases, for a standard ship and a two-lane canal. These densities are used to determine the admissable traffic density for a section and a selected traffic sequence. The equation traffic quantity equals traffic density times speed, gives us the technical operating capacity as a boundary value for the traffic quantity. The traffic capacity can be derived from this equation. The article is written in French and includes a summary written in English. (Grossman-Rutgers)
W70-01845

GENERAL REPORT: (METHODS FOR ASSESSING THE TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY),
Ingenieur General dea Ponts et Chaussees.
Ph. Deymie.
In: Perma-Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Paper Sect 1, Subj 4, p 1-26, 1969. 26 p.

Descriptors: Navigable waters, *Economics, *Inland waterways.
Identifiers: Transportation capacity.

The General Report presents summaries of the reports on inland navigation by the following countries: Germany, Argentina, France, Italy, Japan, The Netherlands, Poland, and the United States of America. The purposes of these reports are to select parameters and determine methods for assessing transport capacity of navigable waterways, taking into account the composition of the river fleet and economic factors abstracts of these reports are forwarded with their particular publications. Two copies of the general report are included: One report is written in English and one in French. (Grossman-Rutgers)
W70-01846

PAPER: (TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY),
Netherlands Rijkswaterstaat, The Hague.
H. A. Ferguson, H. Engel, and S. I. E. Blok.
In: Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Paper Sec 1, Subj 4, p 97-115, 1969. 18 p, 6 fig.

Descriptors: *Navigable rivers, *Channels, Inland waterways.
Identifiers: *Traffic capacity, Volkerak locks, The Hague.

The navigable waterways in the Netherlands must be able to take the ever-increasing amount of traffic and meet the increase in sea port activities. The capacity of a navigable waterway depends on a large number of parameters. Some of these, such as the principle characteristics of the waterway, its cross-section of discharge, its lay-out and its dominant currents, are easy to determine. Other parameters are difficult to evaluate: the reciprocal action of the waterway on the boats and vice versa, and the action of the boats on one another. Three methods of traffic analysis are distinguished: calculation, study on models, and in site observations. The capacity of a waterway and degree of traffic fluidity are defined and examined. The Volkerak locks are described as to traffic capacity. The article is written in English with the summary and conclusions written in French. (Grossman-Rutgers)
W70-01848

PAPER: (TRANSPORT CAPACITY OF AN ARTIFICIAL WATERWAY) (IN FRENCH),
Navigazione Interna e Trasporti Internazionali, Milan (Italy).
Dr. Ing. Mario Tanci.
In: Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Paper, Sect 1, Subj 4, p 53-76, 1969. 24 p, 3 tab.

Descriptors: *Artificial water courses, Economic impact, *Channels, Inland waterways.
Identifiers: *Transport capacity.

The transport capacity of an artificial waterway depends upon its characteristics ans specifically on: the number of locks, their distribution along the waterway and their output; and the river fleet and its degree of heterogeneity which influences the possibility of regulating the traffic which, in its turn, is in relation with social and economic condition of adjacent regions, and in relation with influential areas and competitive conditions with other means of transportation. The deductive method is used in assessing the transport capacity of an artificial waterway in Italy. An economic prospect of the proposed artificial waterway is that industrial factories can be set up near to distribution and consumer centers. Surveys are made to determine the zones of influence of each river port and to define the consequent industrial localities. The article is written in Italian and contains an English summary. (Grossman-Rutgers)
W70-01849

PAPER: (EVALUATION OF THE TRANSPORT CAPACITY OF A NAVIGABLE WATERWAY) (IN FRENCH),
Michel Rousselin.
In: Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Paper, Sect 1, Subj 4, p 35-52, 1969. 18 p, 1 tab, 1 fig.

Descriptors: *Simulation analysis, *Locks, Canals, Mathematical studies.
Identifiers: *Optimum economic capacity.

This paper is largely concerned with the notion of capacity of a lock or group of locks of a canal or canalized river. Two methods are explained for determining this capacity. The first method, called the classic method, consists of calculating, for a lock, the optimum economic capacity, from the theoretical maximum annual capacity, by applying a number of reduction factors. The second, called the simulation method, determines the optimum economic capacity by utilizing the results of simulation on computers using programs established on the basis of a mathematical model. With this method the laws of arrival of boats and their dimensions, as well as traffic fluctuations, are taken into account less empirically than the classic method. Both methods are discussed thoroughly. The article is written in French and contains an English summary. (Grossman-Rutgers)
W70-01850

ANALYSIS OF SHIPPING TRAFFIC CAPACITY OF NARROW WATERWAYS - ON THE URAGA CHANNEL,
Ministry of Transport (Japan).
Shunsaku Nishida, Nobuo Watanabe, and Hajime Eguchi.
Perma Int Asso of Navigation Congr XXIInd Int Navigation Congr, Paper, Sect 1, Subj 4, p 77-96, 1969. 20 p, 8 fig, 6 tab.

Descriptors: *Systems analysis, *Channels, Open channel flow.

Utilizing traffic forecasts for the bay ports, and assuming the relationship between that traffic and the traffic passing through the channel to be constant, it is possible to ascertain the latter for the forthcoming years. Furthermore, assuming the distribution of traffic between the various categories of ships to be invariable, it is possible to estimate future traffic for each of these categories. A simulation model is used to determine future traffic. Two types of data are used: those relative to the shape, length, width, and navigation rules of the fairway; and those relative to the speed and safety perimeter of ships. Traffic is calculated on a basis of maximum ship density at the peak hour. The simulation model furnishes the admissible volume of traffic. Plans for the development of the channel are examined. The article is written in English and contains a summary written in French. (Grossman-Rutgers)
W70-01851

USES OF SMALL URBAN RIVER VALLEYS,
Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering Science.
Ira L. Whitman.
Corps of Engineers, Baltimore District, P O Box 1715, Baltimore, Md 21203, Apr 1968. 310 p, 26 tab, 24 fig, 16 photo, 128 ref, 2 append.

Descriptors: *Land use, City planning, Recreation, Parks, Environmental effects, Value.
Identifiers: *Urban river valleys, Land-value enhancement.

Small river valleys and their land uses were studies in Baltimore, Bridgeport, Fort Wayne, Milwaukee, San Antonio and Washington. Valley park areas are considered in relation to valley properties, and the recreation uses best suited to those properties are determined. A method is developed for rating quality of natural environment in urban valleys. A dependency of urban valley environment upon land use was established. Recreation is closely related to physical conditions and properties. Many recreation activities are enhanced by a high degree of natural environment in urban valleys. Valley planning should begin with measures to preserve and maintain existing qualities. Valley development should be judged on its effect upon existing valley environment. Environmental analyses must accompany valley planning. (Grossman-Rutgers)
W70-01852

URBAN REDEVELOPMENT IN INDIANAPOLIS: A BENEFIT-COST ANALYSIS,
Connecticut Univ., Storrs.
Stephen D. Messner.
Journal of Regional Science, Vol 8, No 2, p 149-158, Winter 1968. 10 p, 12 ref.

Descriptors: *Economic impact, *Investment, *Cost-benefit analysis, *Urban renewal, *Government, Resource allocation, Federal government, Costs, Project planning, Financing, Benefits, Value, Programs.
Identifiers: *Slums, Spillover, Social costs, Social benefits, Land value, Redistribution effects, *Redevelopment.

This study considers the validity and effectiveness of benefit-cost analysis, with particular application to selected redevelopment projects in Indianapolis, Indiana. The form of the analysis first developed by Jerome Rothenberg is used to study the benefits of slum clearance in the area. There were three possible benefits studied: (1) internalizing externalities affecting land use; (2) the spillover effects on other properties; and (3) the reduction of certain slum-associated external social costs. The author finds that the application of benefit-cost analysis to urban redevelopment is clearly not yet at the point where projects and alternatives may be ranked with the technical precision found in the area of water resource development. Although not concerned specifically with water resources, this article provides valuable insights into the application of benefit-cost analysis to public investments which should prove useful to the water researcher. (Murphy-Rutgers)
W70-02006

CRITERIA FOR EVALUATING REGIONAL DEVELOPMENT PROGRAMS,
Tennessee Valley Authority, Knoxville.
John V. Krutilla.
American Economic Review, Vol XLV, No 2, p 120-132, May 1955. 13 p.

Descriptors: *Regional analysis, *Investment, Economics, Cost-benefit analysis, Income, Financing, Agriculture, Natural resources, Capital, Demand, Water resource development, Reservoirs, Costs, Supply, Statistics, Benefits.
Identifiers: *Regional development, *TVA, MPC, Regional multiplier.

This paper discusses the nature of the problem of regional development. The author claims that an approach which attempts to evaluate each program activity individually (for its impact on the sector of the economy toward which it is directed) is superior to regional comparisons of relative change in economic indicators. This is due to errors in the latter method as well as the national orientation of many programs. Benefit-cost analysis is found to be useful as an investment criterion rather than an evaluation criteria in the region of the development program. The most fruitful approach is an analysis of the process of development and how regional development programs may influence that process. Both because of its numerous references to the TVA and the significance of regional development programs in the water resources area, this article has relevance to water program evaluation methods. (Murphy-Rutgers)
W70-02009

URBAN AREA WATER CONSUMPTION: ANALYSIS AND PROJECTIONS,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 06D.
W70-02010

THE BURDEN OF THE DEBT AND FUTURE GENERATIONS IN LOCAL FINANCE,
Miami Univ., Oxford, Ohio.
For primary bibliographic entry see Field 06C.
W70-02011

EXTERNALITIES, WELFARE, AND THE THEORY OF GAMES,
Carnegie Inst. of Tech., Pittsburgh, Pa.; and Yale Univ., New Haven, Conn.
Otto A. Davis, and Andrew Whinston.
The Journal of Political Economy, Vol LXX, No 3, p 241-262, June 1962. 22 p.

Descriptors: *Welfare economics, *Government, Taxes, Optimization, Government supports, Industrial production, Benefits, Costs, Equilibrium, Mathematical studies, Prices, Marginal cost, Economics, Pricing, Profit.
Identifiers: *Externalities, *Welfare maximization, *Separability.

It is usually said that if firms create external economies and diseconomies, the proper role of a welfare-maximizing government is to constrain the behavior of firms by arranging rates of taxes and subsidies in order to equate private with social benefits. The authors establish the conditions under which this policy will work and of those under which it won't. They argue that firms act to eliminate externalities through mergers, that technological externalities can be divided into separable and non-separable and that the classical scheme will work only in the separable cases. If the externality is non-separable, the classical prescription cannot work even at the conceptual level. The authors attempt to circumvent the problems presented by this to policy makers by several alternative policy approaches. Due to the externalities often found in wate resource projects, this article should prove applicable in understanding the theoretical implications of externalities in the water resource area. (Murphy-Rutgers)
W70-02013

ADVOCACY AND RESOURCE ALLOCATION DECISIONS IN THE PUBLIC SECTOR,
Bowdoin Coll., Brunswick, Maine.
For primary bibliographic entry see Field 06C.
W70-02014

PLANNING 1968.
American Society of Planning Officials, Chicago, Ill.

Selected Papers from the ASPO National Planning Conference, San Francisco, May 4-9, 1968. 322 p.

Descriptors: *Planning, *Conservation, Resources, Government, Economics, City planning, Social change, Political aspects, Statistics, Transportation, Education, Regional analysis, State government, Long-term planning, Area redevelopment.
Identifiers: *Economic development, Physical planning standards, Urban design.

This is a collection of papers presented at the American Society of Planning Officials (ASPO) annual conference. The bulk of the papers are concerned with the various aspects of city planning. Sections are devoted to such subtopics of this area as city rioting, city government, sociological factors, education, and state influences. There is a large section, however, on the influence of economics and economic development on the conservation area. Papers are presented on alternative uses of the natural environment, conservation and exploitation as well as the influence of the economist on the 'new' conservation. Although concerned with the larger area of conservation in general, the principles developed and suggestions made should prove directly applicable to the area of water resource planning. The proceedings conclude with papers comparing the results of planning in Alaska, Hawaii and Puerto Rico. (Murphy-Rutgers)
W70-02015

A NOTE ON THE MEASUREMENT OF THE BENEFITS FROM PUBLIC INVESTMENT IN NAVIGATION PROJECTS,
Chicago Univ., Ill.
Edward F. Renshaw.

American Economic Review, Vol XLVII, No 5, p 652-662, Sept 1957. 11 p, 1 fig, 1 tab.

Descriptors: *Investment, *Benefits, *Costs, Navigation, Government supports, Multipurpose projects, Interest rate, Discount rate, Economics, Cost-benefit analysis, Demand, Water conveyance, Harbors, Rivers.
Identifiers: *Corps of Engineers, Discounting, Social costs, Incremental costs, Opportunity costs.

In this paper an attempt is made to apply elements of economic theory to the established procedure used by the Corps of Engineers to estimate navigation benefits from federal navigation improvement projects. The author wishes to see whether or not contemporary public investment in navigation projects can be reasonably justified on the basis that expected benefits will exceed costs. Thus, the theory underlying benefit estimation is outlined and the Corp's benefit estimation procedures judged by these standards. The measurement and discounting of navigation costs is discussed and an argument is made for a more realistic analysis. The author's main conclusion is that navigation costs ought to be reimbursed by the direct beneficiaries rather than by public subsidy. (Murphy-Rutgers)
W70-02016

SECONDARY BENEFITS, EXTERNAL ECONOMIES AND THE JUSTIFICATION OF PUBLIC INVESTMENT,
California Univ., Berkeley.
Julius Margolis.
Review of Economics and Statistics, Vol XXXIX, No 3, p 284-291, Aug 1957. 8 p.

Descriptors: *Indirect benefits, *Irrigation, Capital, Costs, Labor, Government, Cost-benefit analysis, Transportation, Income, Water resources, Project planning, Prices, Equilibrium, Marketing profits, Dams, Planning.
Identifiers: *External economies, *Bureau of Reclamation, Social costs.

One argument often used to justify public services is that the benefits of the activity cannot be limited to the direct recipients of the services. These benefits, which accrue to a large sector of the nation, are indirect benefits. This paper focuses on the use of the concept and its measurement by the Bureau of Reclamation. The types of public investments studied are dams and distribution systems for irrigation projects. The concept and measurement of secondary benefits is discussed. A large section is devoted to attacking the claim that secondary benefits develop because of expansion in complementary industries. The author feels that the procedures followed by the governmental agencies are confusing and incorrect but that secondary benefits can be significant. The author states that the Bureau should compare the economic growth of Western areas with irrigation against those Eastern areas with soil-treatment programs. (Murphy-Rutgers)
W70-02017

REGIONAL ECONOMICS,
Illinois Univ., Urbana.
Hugh O. Nourse.
New York, McGraw-Hill Inc, 1968. 240 p.

Descriptors: *Regional analysis, *Mathematical models, Labor, Resources, Demand, Transportation, Federal government, Average cost, Cost, Income, Input-output analysis, Government planning.
Identifiers: *Income distribution, Capital supply, Trade, Markets, Central places.

This book was meant to serve as an introduction to location theory and regional economic development. Since it studies the geographic allocation of scarce resources the water resource planner is consequently a vital participant in this field. The book constructs economic models of the spatial pattern of economic activity which fit into the traditional models of the economy. Of interest to the water researcher are the sections on industrial location patterns dealing with geographic dispersion of manufacturing and variations in input prices. The measurement of regional economic activity and the interregional theory of income and trade are discussed. The chapters on regional economic growth and the impact of growth on regional structure contain much of the theory necessary for successful water development. The final chapter is on the role of government in solving some of these problems. (Murphy-Rutgers)
W70-02018

THE USES AND ABUSES OF ECONOMICS,
Hull Univ. (England).
Eric Roll.
Oxford Economic Papers, Vol 20, No 3, p 289-302, Nov 1968. 14 p.

Descriptors: *Resource allocation, *Growth rates, Government, Economics, Management, Investment, Income, Stabilization, Demand, Political aspects, Economic evaluation.
Identifiers: *Economic policy, Monetary policy, Fiscal policy, Macro-economics, Balance of payments.

The author takes, as his main theme, the application of the understanding which economic analysis can provide towards the better ordering of human affairs. With the increased use of economics in the water resource area, an understanding of its limitations and possibilities is essential to the water resource planner. The author points out the faults he finds with the main tools of economic management and monetary and fiscal policy. The author regards with suspicion the speed with which new economic tools have been adopted. The necessity for vigilence in regard to the relation between state and private interests is mentioned. The author also feels there is excessive confidence in the efficacy of economics when faced with wider issues of the world of politics. (Murphy-Rutgers)
W70-02019

A SOCIAL ACCOUNTING SYSTEM FOR REGIONAL DEVELOPMENT PLANNING,
Iowa Univ., Iowa City.
Jerald R. Barnard.
Journal of Regional Science, Vol 9, No 1, p 109-116, Apr 1969. 7 p, 2 tab, 11 ref.

Descriptors: *Planning, *Income, *Regional analysis, Input-output analysis, Capital, Government, Budgeting, Economic analysis, Statistics, Investment.
Identifiers: *Accounting system, *Flow-of-funds accounts, *Social accounting system, Development planning, Structural adjustment, Depreciation.

This paper considers the types of information that would be useful in a system of social accounts for analyzing economic change with reference to regional development planning. It presents an overview of a system of accounts in the form of social accounting matrix that was developed for generating information about state economic structures. The social accounting matrix provides an accounts system that is descriptive of the various transactors of a state economy and indicates the interrelationships among sectors. It is a seventy-sector matrix that incorporates the concepts underlying input-output tables and income and product accounts. The system uses a set of multiple classifications which prove to be interesting because they provide a means of more accurately depicting the functional relationships among the sectors. Since regional development planning is an integral part of water resource planning, this article should be informative to the water researcher. (Murphy-Rutgers)
W70-02020

SHIFT AND SHARE PROJECTIONS OF REGIONAL ECONOMIC GRWOTH: AN EMPIRICAL TEST,
Indiana Univ., Bloomington. Inst. for Applied Urban Economics.
H. James Brown.
Journal of Regional Science, Vol 9, No 1, p 1-17, Apr 1969. 17 p, 7 tab, 15 ref.

Descriptors: *Regional analysis, *Planning, Economic analysis, Competition, Employment, Marketing, Labor supply, Population.
Identifiers: *Shift and share projections, *Economic growth, Variation, Covariation, Industry growth rates.

This paper reports on an empirical test of a shift and share projection model and an analysis of the competitive component over time. The author develops the projection model and compares its projections with those of two simple alternative models. The results show that shift and share projections are less precise than either of the alternatives. The author also examines the critical competitive component in the hope of discovering why the model projects poorly and how well the competitive component reflects the economic forces that have been ascribed to it. The analysis casts coubts on the ability of the technique to predict and even to describe regional economic growth. Due to the important role of water development in regional planning, this article should prove of interest to water resource planners. (Murphy-Rutgers)
W70-02021

PROPOSED PRACTICES FOR ECONOMIC ANALYSIS OF RIVER BASIN PROJECTS.
Inter-Agency Committee on Water Resources, Washington, D.C.

Report to the Inter-Agency Committee on Water Resources, Subcommittee on Evaluation Standards, May 1958. 56 p.

Descriptors: *Cost-benefit analysis, *River basin development, *Cost allocation, *Irrigation, *Flood control, *Multiple-purpose projects, Planning, Prices, Interest rate, Cost, Sharing, Direct benefits, Indirect benefits, Income, Economic analysis, Economic justification, Discount rate, Project life, Taxes, Labor, Drainage, Navigation, Risks, Amortization.
Identifiers: *Tangible benefits, *Intangible benefits, Land acquisition, Cost measurement, Risk allowances.

The first chapter of this paper serves to acquaint the reader with previous studies of benefit-cost ciriteria. The basic principles and concepts involved in benefit-cost analysis are discussed in Chapter II. Attention is focused on effects attributable to water projects, the nature of benefits, and the effects of alternative opportunities on evaluation and project formulation. Chapter III covers general principles and procedures for project and program formulation. The standards, problems and procedures involved in the measurement of benefits and costs are the subject of Chapter IV. There include among others, price levels, interest rates, risk allowances, tangible and intangible benefits, treatment of costs of effected public facilities and treatment of taxes. Chapter V is concerned with the applications of principles and procedures for analysis of various project purposes. The application of data on benefits and costs in allocation of costs among project purposes is discussed in the last chapter. (Murphy-Rutgers)
W70-02022

WATER RESOURCE INVESTMENT AND THE PUBLIC INTEREST,
Grinnel Coll., Iowa.
Robert H. Haveman.
Nashville, Tennessee, Vanderbilt University Press, 1965. 199 p.

Descriptors: *Regional analysis, *Water resource development, Cost allocation, Benefits, Economic analysis, Political aspects, Income analysis, Risks, Economic efficiency, Capital, Cost-benefit analysis, Interest rate, Investment, Flood control, Project life, National income, Welfare economics, Political aspects, Government.
Identifiers: *Income distribution, *Depressed areas, *Regional development, *Congress, *Corps of Engineers.

This book is a regional study dealing with appropriations to the Corps of Engineers projects in ten southern states since World War II. It assumes that the Federal endeavor must have as its goal the maximization of social welfare depending on the size and distribution of national income. Thus, the two forces of economic efficiency and income distribution are analyzed as determinants of water resource appropriations. The formal process of project evaluation is described, the importance of the two concepts as Congressional criteria discussed and an analysis is made of the income distribution effects of projects in ten southern states. Postwar projects are evaluated according to their economic efficiency and the effect of this criteria on regional income distribution is discussed. In the final section an attempt is made to combine both of these primary determinants of changes in economic welfare into a single multidimensional approach. (Murphy-Rutgers)
W70-02023

FORECASTING WITH ECONOMETRIC MODELS: AN EVALUATION,
State Univ. of New York, Stony Brook.
H. O. Stekler.
Econometrica, Vol 36, No 3-4, p 437-463, July-Oct 1968. 27 p.

Descriptors: *Model studies, *Forecasting, *Mathematical studies, Economic justification, Economic analysis, Gross National Product, Income, Economics, Taxes, Government, Investment, Cycles.
Identifiers: *Econometrics, *Ex post, *Ex ante, Coefficients, Disposable income, Inventory, Housing.

The paper attempts to determine the ability of existing econometric models to generate quantitative forecasts of aggregate economic activity. The models evaluated are the Klein Quarterly Model, the OBE Model, the Fromm Model, the Lice Model, the Friend and Jones Models, and the Friend and Taubman Model. The main characteristics of each model are reviewed and the variety of methods that may be utilized to evaluate these models are discussed. The combination of all the results suggests that econometric models have not been entirely successful in forecasting economic activity. The results could be more meaningful if all the models had been tested on data for the same period or if those predictions had been compared with projections which had been generated by other techniques. The growing role of econometric models in water resource planning makes this article relevant to the water area. (Murphy-Rutgers)
W70-02024

CRITERIA FOR UNDERTAKING WATER-RESOURCE DEVELOPMENTS,
California Univ., Berkeley.
Joe S. Bain.
American Economic Review, Vol L, No 2, p 310-320, May 1960. 11 p.

Descriptors: *Project planning, *Water resource development, Social aspects, Investment, Budgeting, Irrigation, Prices, Water rates, Optimization, Benefits, Economics, Costs, Intangible benefits, Demand, Income, Interest rate, Capital, Operating costs, Capital costs, Discount rate.
Identifiers: *Social welfare, *Investment criterion.

The article evaluates the criteria for undertaking water-resource development projects in view of the social priorities which alternative criteria may express or implement. The author treats: (1) the general investment criterion, as defined in terms of the relation of benefits to costs and as made specific for assumed constraints on the investing agency's budget; (2) THE INTEREST RATE TO BE USED IN DISCOUNTING FUTURE EVENTS AND COSTS; (3) the timing of investment and the avoidance of premature investment; and (4) the influence of procedures in benefit calculation on the design of projects, with attention given to the role of intangible benefits. The author feels that increased attention is needed to the choice of theory in light of information on actual institutional constraints, to the promulgation of constraint systems, and to detailing the manner in which the procedures for applying theoretical investment criteria may alter the content of the criteria as applied. (Murphy-Rutgers)
W70-02025

THE PROCESS OF MAKING GOOD DECISIONS ABOUT THE USE OF THE ENVIRONMENT OF MAN,
Calgary Univ. (Alberta).
Louis Hamill.
Natural Resources Journal, Vol 8, No 2, p 279-301, Apr 1968. 1 tab, 21 ref.

Descriptors: *Decision making, *Operations research, *Methodology, Economics, Planning, Forecasting, Education.
Identifiers: Process orientation, Alternative actions, Decision-making criteria.

After summarizing objections to economic theory as a basis for making decisions on resource use, the article presents an alternative procedure derived from operations research and management science. Section I described a simplified decision model, based on five premises: (1) decision is required only when there are alternative actions, only one of which may be taken; (2) each alternative will have different consequences; (3) efficient decision making requires consideration of all possible alternatives; (4) decision makers must have a set of criteria to evaluate all combinations of alternatives; and (5) action will be taken immediately on the preferred alternative. Section II considers procedures that make the decision model operational, including: (1) initiation of the process; (2) identification of alternative actions; (3) how to forecast consequences of action; (4) stating objectives; (5) ranking combinations of actions and consequences in terms of objectives; and (6) stating instructions for action. The decision process should be continuous because external conditions, available techniques or objectives may change. Use of the operational procedure for decision making will have important implications for the education of resource analysts. This approach will reduce the amount of education required for competent analysts by reducing present reliance on theoretical subjects. (Gossen-Chicago)
W70-02026

PRESERVATION VALUES IN RIVER BASIN PLANNING,
Izaak Walton League of America.
Roger Tippy.
Natural Resources Journal, Vol 8, No 2, p 259-278, Apr 1968. 56 ref.

Descriptors: *Preservation, *Water resources development, Legislation.
Identifiers: *Comprehensive planning, *Consideration of alternatives, *Democratic decision making, Congressional powers, Corps of Engineers, Federal Power Commission, Department of the Interior, Upper Missouri River basin.

Section I delineates preservation values from development values. Federal policy on comprehensive planning, as expressed in Senate Document 97, holds that planners should present decision makers a choice of alternatives. Experience reveals that planners compromise the several values to present a single answer. Section II illustrates this point by examining development decisions of the Corps of Engineers, the Federal Power Commission and the Department of the Interior. Section III analyzes past preservation decisions and present legislative proposals. It is recommended that a Scenic Rivers Act be passed to create a format for making affirmative preservation decisions about a river's use, and to require that development recommendations explicitly consider preservation alternatives and vice versa. Section IV gives an example of such comprehensive planning. Representing conflicting interests in the Upper Missouri River, the Department of the Interior and the Corps of Engineers jointly produced a booklet illustrating the possibilities of full development, full preservation and various compromises. Resultant debates delayed decision making, but allowed decision makers and private citizens to express their preferences. The article recommends that Congressional Committees on Natural Resources be established with the power to select among all alternative uses. (Gossen-Chicago)
W70-02027

WATERFRONT PLANNING - COMPREHENSIVE PLANNING OF LAKE MICHIGAN SHORELAND,
Chicago Univ., Ill. Dept. of Geography.
Peter T. Haverkampf.
Lake Michigan Region Planning Council, Project 65-1, 1967. 110 p, 5 maps, 86 ref.

Descriptors: *Lake Michigan, Submerged Lands Act, Wisconsin, Indiana, Illinois, Michigan, Federal jurisdiction, State jurisdiction, Riparian rights, Shore protection, Recreation demand, Industrial water, Land use, Landfills, Inter-agency cooperation, Long-term planning.
Identifiers: *Regional planning, *Comprehensive planning, *Conflicting uses, *Waterfront development.

Lake Michigan shoreline lands provide two general categories of uses for two general purposes: personal well-being and economic well-being; these two categories are often not compatible. The author contends that generally it is better to plan for the separation of the two categories of use. Pressures on the resource are increasing--it is easier to increase steel plant production by filling new land than by clearing urban areas. It is easier to state highway planners to put a road on newly made land than to condemn a right-of-way in a heavily populated area, and it is easier to put a water filtration plant or sewage treatment facility on the lake than to run underground pipes and clear areas for inland location. These uses have been proliferating on the shoreline, with the resulting increased pressure for lakefront land. Amelioration of these pressures is made difficult by the fragmented jurisdiction of control over submerged lands and from the various statutes which the four states bordering on Lake Michigan have. The author sees the necessity of an interstate planning authority having the kinds of planning powers that the Tennessee Valley Authority possesses. (Starr-Chicago)
W70-02032

INTRODUCTION TO THE SUBMERGED AND SHORE LAND PROBLEM,
Chicago Univ., Ill. Dept. of Geography.
Peter T. Haverkampf.
In: Waterfront Planning - Comprehensive Planning of Lake Michigan Shoreland, Lake Michigan Regional Planning Council, 1-8, 1967. 5 maps, 86 ref.

Descriptors: *Shore protection, *Lake Michigan, Recreation demand, Industrial water, Land use.
Identifiers: *Conflicting uses, *Comprehensive planning, *Waterfront development, Non-conforming use, National use.

The attributes of the Lake Michigan shoreland are given, and the necessity of planning for the use of this resource is stressed. The importance of providing 'vista' within an urban context is the outstand-

ing attribute of a resource such as Lake Michigan. Closely related to the 'vista' is the unique water-land relationship. Passive and active pleasures which are provided by such a resource, are oftentimes denied because access to lakefronts are traditionally used for water transportation and commercial development in urban areas. Since certain recreation and industrial uses demand riparian rights, criteria should be established to reconcile conflicting demands. Author distinguished between natural or unconforming uses. If a shoreline, as a limited resource is fully utilized, the use is natural; if full advantage of the location is not utilized, due to the nature of the use, the use is unconforming. The example of the Indiana Dunes area is cited as an example of unresolved conflicts between industry and recreation groups, with the result that the limited resource, Lake Michigan is under-utilized. The author suggests resolution of this problem by enforcing strictly the idea of natural uses of the shoreland. Existence of a deep water port for heavy industry would be permissible; however, the industry itself should extend landward rom the port, rather than along the shore. Similarly, recreation uses that are not dependent upon the shoreline should also be placed away from the shore so as to allow more room for natural uses. (Starr-Chicago)
W70-02033

FEDERAL, STATE, AND LOCAL CONTROLS OVER SUBMERGED AND SHORE LAND,
Chicago Univ., Ill. Dept. of Geography.
Peter T. Haverkampf.
In: Waterfront Planning - Comprehensive Planning of Lake Michigan Shoreland, Lake Michigan Regional Planning Council, Project 65-1, p 8-22, 1967. 5 maps, 86 ref.

Descriptors: *Lake Michigan, Submerged Lands Act, Wisconsin, Indiana, Michigan, Illinois, Riparian rights, Federal jurisdiction, State jurisdiction.
Identifiers: *Public Law 31.

The difficulty in making comprehensive plans for the Lake Michigan shoreline, lies in the fact that there is no central authority. Four state governments (Michigan, Illinois, Wisconsin and Indiana) have the power to regulate these lands. Further complicating the jurisdictional problem is the fact that these state governments have delegated to other governing bodies control over the submerged lands. Legislation such as the 'Submerged Lands Act' of 1953 and Public Law 31 give federal sanction to the states for control over submerged lands. Variations in the state laws of the four states surrounding Lake Michigan cause widely divergent patterns of industry, public and private development. The state laws are summarized and discussed. The author suggests that the development of riparian law in the respective states is an important reason for these divergent patterns. (Starr-Chicago)
W70-02034

FOUR CASE STUDIES: THE PRESENT POSITION OF LANDFILL PLANNING PROBLEMS,
Chicago Univ., Ill. Dept. of Geography.
Peter T. Haverkampf.
In: Waterfront Planning - Comprehensive Planning of Lake Michigan Shoreland, Lake Michigan Regional Planning Council, Project 65-1, p 22-72, 1967. 5 maps, 86 ref.

Descriptors: *Lake Michigan, *Recreation demand, *Industrial water, Landfills, Land use.
Identifiers: *Comprehensive planning, *Conflicting uses, *Waterfront development.

As a result of the fragmented jurisdiction over submerged and shoreland land use of Lake Michigan, the shoreline must be viewed as a scarce resource. The situation in Chicago, where recreational uses have almost complete control over the city's Lake Michigan shoreline is little better than the situation in Gary, Indiana, where the highest bidder controls almost all the shore. Present legal structure is analyzed in order to understand problems and possibilities for shoreline land use. Land use on the Milwaukee lakefront is cited as exhibiting a balance of uses that comes close to an optimal utilization of the lakeshore and submerged land resource. A review of the Illinois Central Railroad and Lake Michigan Landfill in Chicago is made. Supreme Court rulings which returned all riparian rights to the city and chastised the State of Illinois for giving away control of submerged lands ultimately ended the Illinois Central's control of land. The United States Steel submerged lands controversy is seen as emerging because of lack of mutual planning and cooperation between industry and conservationists. Because of its location on the Illinois-Indiana boundary, multi-state planning is needed to provide for both recreational and industrial uses. The Indiana Dunes conflict is given as a prime example of conflicting demands upon a limited resource. The compromise which was eventually reached was one-sided. The need for some planning authority to reconcile the intense competition between the steel companies and the conservationists is emphasized. (Starr-Chicago)
W70-02035

EXISTING GOVERNMENTAL AIDS TO COMPREHENSIVE LAKE MICHIGAN SHORELINE PLANNING,
Chicago Univ., Ill. Dept. of Geography.
Peter T. Haverkampf.
In: Waterfront Planning - Comprehensive Planning of Lake Michigan Shoreland, Lake Michigan Regional Planning Council, Project 65-1, p 72-100, 1967. 5 maps, 86 ref.

Descriptors: *Lake Michigan, *Submerged Lands Act, Federal project policy, *Inter-agency cooperation, Long-term planning.
Identifiers: *Regional planning, *Comprehensive planning, *Federal aid, Technical assistance.

The scope of a plan would utilize the shore to its optimal potential, and yet provide all necessary and natural shoreline uses, is outlined. The plan, at the minimum, should encompass regional planning, especially in terms of the four states surrounding the lake, but also in viewing the Lake Michigan basin as part of the Great Lakes region. Because of the concentration of people in two major urban centers, Chicago and Milwaukee, recreational and industrial needs must be met in a region which does not follow political or economic boundaries. Reviewed are the statutory devices, inter and intrastate regional planning groups, state authorities, local governmental powers and potential individual efforts available for providing such a regional plan. Federal aids to comprehensive Lake Michigan Shoreline Planning include: (1) financial and technical assistance in establishing the best land resource allocation on a local level; (2) financial help for land purchase; (3) support of local planning programs; and (4) federal participation in the land market, through purchase of land. The failure of comprehensive planning for the Lake Michigan shorelands is seen as the result of the fact that ultimate responsibility still rests at the local level. Even though local power is derived from the state, this condition has come about because of a lack of interest in planning at the state level. The author concludes that a 'foresighted and neutral authority' can control the resource for the best long term development. (Starr-Chicago)
W70-02036

A MODEL FOR QUANTIFYING FLOW AUGMENTATION BENEFITS,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05G.
W70-02039

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ALTERNATIVE FEDERAL POLICIES FOR STIMULATING STATE AND LOCAL EXPENDITURES: A COMPARISON OF THEIR EFFECTS,
Board of Governors of the Federal Reserve System, N.Y.
Edward M. Gramlich.
National Tax Journal, Vol XXI, No 2, p 119-129, June 1968. 11 p, 2 tab.

Descriptors: *Government, *Economics, Federal government, State government, Local government, Budgeting, Government supports, Taxes, Statistics, Interest rate, Model studies, Capital, Income analysis.
Identifiers: *Expenditures, *Grants-in-aid, *Bloc grants, Utility analysis, Fiscal policy, Monetary policy.

This paper compares the effects of several alternative Federal policies, either in existence or under discussion, which influence the budgets of states and localities. The policies include three kinds of grants: matching; grants-in-aid; unconditional bloc grants; and bloc grants conditioned with effort formulas; along with monetary policy; Federal personal tax reductions and income tax credit. The basis of the paper is a utility maximization analysis for state and local governments. The first section of the paper sets out the utility analysis and shows how alternative policies would enter into the second section uses statistical estimates of the relevant parameters to give quantitative measures of the state and local response to Federal policies. This article has relevant to the water resource area due to the increasing number of stimulative grants by the Federal government to states and localities in this field. (Murphy-Rutgers)
W70-02005

THE MAGNITUDE OF THE DISCOUNT RATE FOR GOVERNMENT PROJECTS,
Auburn Univ., Ala.
William C. Miller.
The Southern Economic Journal, Vol XXVIII, No 4, p 348-356, Apr 1962. 9 p.

Descriptors: *Discount rate, *Interest rate, *Government, Project planning, Benefits, Costs, Taxes, Capital, Inflation, Employment, Budgeting, Economic efficiency, Financing, Demand, Income, Population, Economic feasibility.
Identifiers: *Social costs, Economic evaluation.

Using the work of Otto Eckstein as a point-of-departure, the author investigates the proper size of the discount rate for government projects. He argues that an average of rates of interest and returns in the private sector sets too high a minimum. He believes that substantially the same discount rate appropriate for projects financed by taxation under circumstances of full employment should be used during mild inflation but not hyperinflation. He proves that substantially the same discount rate should be used regardless of the level of employment. In addition, until all alternatives have been investigated and found wanting, the discount rate should not be lowered to promote development of lagging regions. Due to the large amount of government investment in the water resource area and the important role of the discount rate in cost benefit analysis this article should be of value to the water resource planner. (Murphy-Rutgers)
W70-02007

THE PURE THEORY OF PUBLIC EXPENDITURE,
Massachusetts Inst. of Tech., Cambridge.
Paul A. Samuelson.
The Review of Economics and Statistics, Vol 36, No 4, p 387-389. Nov 1954. 3 p.

Descriptors: *Welfare economics, *Marginal utility, Economics, Mathematical studies, Government, Finance, Pricing, Taxes, Budgeting, Prices.
Identifiers: *Collective goods, *Private goods, Consumption, Utility curve, Production-possibility schedule, Marginal principle, Marginal rate of substitution, Voting.

The author assumes two categories of goods, private and collective consumption goods, with individuals having ordinal preferences and a convex and smooth production-possibility schedule relating totals of all outputs. Given the normal social welfare function the optimal state is defined by the marginal conditions stated by the author in the equations. However, there is no decentralized pricing system which can serve to determine, optimally, the levels of collective consumption. Various kinds of voting outlined by the author are shown to be inadequate. Due to the public good aspects of the water resource area the basis of public expenditures theory for public goods provided in this pioneering article should improve theoretical understanding of water problems. (Murphy-Rutgers)
W70-02008

THE BURDEN OF THE DEBT AND FUTURE GENERATIONS IN LOCAL FINANCE,
Miami Univ., Oxford, Ohio.
George C. Daly.
Southern Economic Journal, Vol XXXVI, No 1, p 44-51, July 1969. 8 p.

Descriptors: *Debt, *Financing, *Taxes, Costs, Economics, Local government, Income, Capital, Benefits, Value.
Identifiers: *Burden of debt, *Local debt, Tax shifting, Intergeneration incidence, Internal debt, External debt.

There is a large quantity of debt issued by municipalities, school districts, and states, which is held primarily by individuals who do not reside within the boundaries of the issuing entity. The author wishes to examine to what extent, if any, this type of government debt imposes a burden on the future. The author examines the recent literature and finds the traditional argument to be that because local borrowing is largely external, it can shift the cost of current projects to future generations. The burden under alternative financing schemes of debt financing and taxation is examined under two different sets of assumptions. The author finds the traditional arguments to be weak and finds that there exists no fundamental distinction between internal and external public debt with respect to the question of intergeneration incidence. Due to the importance of local debt financing in many water resource projects this article is relevant to the water area. (Murphy-Rutgers)
W70-02011

EXTERNALITIES, WELFARE, AND THE THEORY OF GAMES,
Carnegie Inst. of Tech., Pittsburgh, Pa.; and Yale Univ., New Haven, Conn.
For primary bibliographic entry see Field 06B.
W70-02013

ADVOCACY AND RESOURCE ALLOCATION DECISIONS IN THE PUBLIC SECTOR,
Bowdoin Coll., Brunswick, Maine.
A. M. Freeman.
Natural Resources Journal, Vol 9, No 2, p 166-175, Apr 1969. 10 p, 13 ref.

Descriptors: *Resource development, Taxes, Government supports, Benefits, Economic justification, Costs, Value, Model studies, Resource allocation.
Identifiers: *Information availability, Resource cost, Grand Canyon, Sierra Club.

The economists' discussion of resource allocation decisions in the public sector has concentrated on either developing rules for making optimizing decisions and analytical techniques to support these rules or the normative and positive analysis of the decision-making process. The author desires to explain the observed set of public decisions and to suggest ways of altering the framework within which the decisions are made so as to produce better decisions. Thus, a particular structure for making decisions in the public sector is considered and its implications for achieving an optimum resource allocation is discussed. Conclusions are reached on the role of available information and the side effects in decision-making as well as the role of organizations seeking to influence the process. Due to the large part played by the public sector in water resource development this article should prove useful. (Murphy-Rutgers)
W70-02014

SECONDARY BENEFITS, EXTERNAL ECONOMIES AND THE JUSTIFICATION OF PUBLIC INVESTMENT,
California Univ., Berkeley.
For primary bibliographic entry see Field 06B.
W70-02017

A SOCIAL ACCOUNTING SYSTEM FOR REGIONAL DEVELOPMENT PLANNING,
Iowa Univ., Iowa City.
For primary bibliographic entry see Field 06B.
W70-02020

WATER RESOURCE INVESTMENT AND THE PUBLIC INTEREST,
Grinnel Coll., Iowa.
For primary bibliographic entry see Field 06B.
W70-02023

6D. Water Demand

WATER MANAGEMENT - A FASHIONABLE TOPIC,
Kline (Charles H.) and Co., Fairfield, N.J.
D. R. Dykes, T. S. Bry, and C. H. Kline.
Environ Sci Technol 1, p 780-84, 1967. 7 tab.
Identifiers: *Water costs estimate, *Water utilization, Agriculture, Ground water recharge, Industries, Product water treatment.

Some of the most important methods of water management are flood control, weather control, pollution control, reuse by recycling, renovation, desalination, and geographic location of the water user. The total estimated U.S. intake of water in 1965 was 356 billion GPD - already more than the available supply of 315 billion GPD. The intake of water in the U.S. will grow at nearly 2.4% a year. Industry has the highest growth rate at 2.8%, followed by steam electric utilities and public water at 2.7% a year each. Use for irrigation is only expected to grow at 1.8% a year. Ground water is the cheapest, ranging from no treatment cost to 20 cents/1000 gal. Surface water treatment costs run from 20 to 40 cents/1000 gal. Waste water can range from 20 to 65 cents/1000 gal. Desalination is still too expensive, $1.00/1000 gal, except in a few select locations. Estimated water renovation costs are listed for 15 different methods. These range from 15 cents/1000 gal for ground water spreading to 66 cents/1000 gal for wet oxidation. (In this table, distillation is listed at 62 cents and electrodialysis at 32 cents.)
W70-01746

WATER RESOURCES APPRAISAL OF THE WARM SPRINGS--LEMMON VALLEY AREA, WASHOE COUNTY, NEVADA,
Nevada State Dept. of Conservation and Natural Resources, Carson City.
For primary bibliographic entry see Field 03B.
W70-01806

A BRIEF APPRAISAL OF THE WATER RESOURCES OF THE WALKER LAKE AREA, MINERAL, LYON, AND CHURCHILL COUNTIES, NEVADA,
Nevada State Dept. of Conservation and Natural Resources, Carson City.
For primary bibliographic entry see Field 03B.
W70-01807

PAPER: (DETERMINING THE CAPACITY OF THE ST. LAWRENCE SEAWAY),
St. Lawrence Seaway Development Corp.
Richard H. Miller, Brendon T. Jose, and Carl H. Gaum.
In: Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Paper Sect 1, Subj 4, p 129-150, 1969. 22 p, 5 charts, 1 map.

Descriptors: *Systems analysis, Costs, *Channels, *Inland waterways.
Identifiers: *St. Lawrence Seaway, *Traffic capacity, Economic optimum.

The technical characteristics of the Seaway, and its navigation period are presented. The technical capacity of a waterway in one navigation direction is defined as being the number of boats on the tonnage passing a certain point per unit of time. There are three types of navigation on a section of navigable waterway: free navigation, fully regulated navigation, and restricted navigation. A discussion of the parameters needed for simulation methods is included. The economic capacity of a navigable waterway is defined by an economic optimum corresponding to minimization of the sum of the following costs in relation to the kilometric-ton transported: annual amortization installments of infrastructure expenditure; annual cost of infrastructure operation and maintenance; annual cost of operating the fleet. In conclusion, it appears necessary to perfect accurate methods of determining the capacity of a navigable waterway and the corresponding costs. Also, an economic optimum should be sought, rather than a maximum capacity. The article is written in English and includes a French summary. (Grossman-Rutgers)
W70-01847

URBAN AREA WATER CONSUMPTION: ANALYSIS AND PROJECTIONS,
West Virginia Univ., Morgantown.
Robert J. Saunders.
Quarterly Review of Economics and Business, Vol 9, No 2, p 5-20, Summer 1969. 16 p, 4 tab.

Descriptors: *Economic forecasting, *Least squares method, *Regression analysis, Regional analysis, Conservation, Water utilization, Productivity, Water supply, Water policy, Temperature, Income, Elasticity of demand, Elasticity of supply, Prices, Costs.
Identifiers: *SMSA's, *Free good, *Priorities, Demographic factors, Principal component analysis, Vectors, Urban area size, Per capita water use.

This article deals with the recent increasing concern that water may become a relatively scarce resource in the foreseeable future due to current inefficiencies in water usage. One possible solution is a definite set of priorities for water usage, especially in urban areas where higher productivity uses abound. This article tries to identify factors which, on an aggregate basis, are closely associated with, or which determine, the level of water usage in urban areas and, on the basis of these factors, construct a forecast of water usage for a number of alternative urban areas in the U.S. in 1975. Variations in urban water usage, economic, demographic and water data form the basis for the identification of the various factors. This data was analyzed by principal component analysis and least-squares regression analysis. The factors arrived at related urban size with population and studied income variations, housing differences, and available plumbing, as well as rent and per capita production of water. City size was most important, followed by area income level and per capita water usage.

Using this information, water usage projections were made for 1975. (Murphy-Rutgers)
W70-02010

6E. Water Law and Institutions

CONSERVATION BONDS.

Pa Const Art 8 sec 16.

Descriptors: *Pennsylvania, *Government finance, *Land reclamation, *Water resources development, Resource development, Water resources, Conservation, Financing, Natural resources, Planning, Water conservation, Pollution abatement, Land resources, Drainage, Mine drainage, Water pollution, Sewage, Sewage treatment, Pollution, Water pollution control, Strip mines, Mine wastes, Recreation facilities, Recreation, Acid mine water.

The state may issue bonds for a Land and Water Conservation and Reclamation Fund to be used for the conservation and reclamation of land and water resources, including the elimination of acid mine drainage, sewage and other pollution from the state's streams. The provision of state financial assistance to political subdivisions and municipal authorities shall be for sewage treatment plants, restoration of abandoned strip-mined areas, fighting mine fires, alleviation and prevention of mining operations subsidence, and reclamation and development of park and recreational lands, subject to conditions and liabilities prescribed by the General Assembly. (Smith-Florida)
W70-01673

BULKHEAD LINE: THE LIFELINE OF OUR COASTS,
For primary bibliographic entry see Field 04A.
W70-01704

COUNTY PORT AUTHORITY.
Miss Code Ann secs 7605-01, 7605-06, 7605-09 (1956), as amended, (Supp 1968).

Descriptors: *Mississippi, *Port authorities, *Harbors, *Engineering structures, Legislation, Administrative agencies, Bodies of water, Channels, Navigable waters, Navigation, Ships, Transportation, Cities, Beds, Ownership of beds, Land reclamation, Eminent domain, High water mark, Banks, Lakes, Docks, Piers, Railroads.

A County Port Authority, or a Development Commission in larger counties, may be established upon a resolution by the county supervisors in any county bordering on the Mississippi Sound or the Gulf of Mexico in which a municipality has a harbor handling foreign exports or in which there is a harbor or channel over twenty feet in depth. The Authority has jurisdiction over ports, terminals, harbors, and channels as well as the vessels, wharves, common carriers and public utilities using the same within the county. County supervisors are authorized through the above bodies to improve and develop harbors, channels, and other navigation projects and to develop land for related industrial operations. Harbor facilities and equipment may be leased to private interests by the county following the procedures and limitations prescribed. The county may reclaim submerged lands and tidelands belonging to the state and may exercise the power of eminent domain over private lands. Any Authority has jurisdiction over lands below the mean high tide mark of any river, bay, or lake which are within or adjacent to any port or harbor, and they may be reclaimed for the development of the port. (Douberley-Florida)
W70-01762

COMMERCIAL FISHING DEVICES.
Ill Ann Stat ch 56, secs 192-224 (Smith-Hurd 1967), as amended, (Supp 1969).

Descriptors: *Illinois, *Commercial fishing, *Fishing gear, *Equipment, Legislation, Regulation, Fishing, Commercial shellfish, Electrical shocking gear, Trawling, Nets, Mussels, Permits, Sport-fishing, Sport fish, Lake fisheries.

The terms commercial fisherman and commercial fishing devices are defined. Traps, nets, or seines have restricted use relative to the size of the fish that may be taken. Seasons and size limits for mussels are regulated. Regulations for fish transported into the state and fish taken from waters wholly or in part within the state are provided. Commercial fishermen shall keep accurate records of their catch. Regulatory provisions pertaining to illegal fishing devices such as otter trawls, snares, spears, firearms, artificial lights, and drugs are included. Seining regulations are set forth as are refulations pertaining to lawful net types and sizes. Licensed commercial fishermen must maintain licenses in their possession for the equipment being used. It is unlawful to fish on private property without the consent of the land owner. (Moulder-Florida)
W70-01769

STATE PORTS AND HARBORS ACT.
Miss Code Ann sec 7564-04 (Supp 1968).

Descriptors: *Mississippi, *Harbors, *Piers, *Rivers, Legislation, Administrative agencies, Channels, Inland waterways, Docks, Ships, Boats, Beds, Ownership of beds, Lakes, Land reclamation, Dams, Dam construction, High water mark, Administration.

The Mississippi Agricultural and Industrial Board may acquire and operate ports, harbors, waterways, piers, elevators, loading and unloading facilities, vessels, terminals, and other facilities for the convenient use of commerce. The Board's powers include: (1) the deepening or enlarging of ports, harbors, and waterways; (2) the damming of waterways; (3) the development of industrial sites; and (4) the reclaiming of submerged lands. The Board is vested with jurisdiction and control of all lands below the mean high tide mark that are in or near any state-owned or operated ports, harbors, and waterbodies. (Douberley-Florida)
W70-01770

FISH AND FISHING GENERALLY: FOOD FISH.
Va Code Ann 28.1-47 thru 28.1-57 (1969).

Descriptors: *Virginia, *Shellfish, *Fish management, *Commercial fishing, Permits, Fish establishment, Reasonable use, Productivity, Regulation, Fish conservation, Fishing, Nets, Recreation, Fyke nets, State jurisdiction, Tidal waters, Legislation, Legal aspects, Taxes.

Residents of the state desiring to catch fish in the tidewaters under state jurisdiction, with any device other than a hand line, must be licensed. For the use of fixed fish taking devices, residents must procure a license in the district where the fixed device is located. A specific license tax must be paid which varies with the type of fishing device used. Minimum size limits are established for the taking of certain fish. Limits are established on the number of fish of certain species which are caught. Use of certain fishing nets is prohibited, and the lengths of nets and of other fishing structures are limited. Killing fish by means of explosives, drugs, or poisons is prohibited. Non-residents of the state are prohibited from fishing in the state's tidewaters in any manner other than with a line, rod, or pole. (Kelly-Florida)
W70-01771

DRAINAGE DISTRICTS.
Miss Code Ann secs 4579, 4580, 4606.1, 4606.3, 4606.5, 4618, 4619, 4625, 4641, 4673.5, 4673.7, (1956), as amended, (Supp 1968).

Descriptors: *Mississippi, *Drainage districts, *Land reclamation, *Irrigation, Legislation, Administrative agencies, Wetlands, Drainage, Controlled drainage, Surface drainage, Drainage systems, Drainage water, Soil conservation, Marsh management, Laterals, Outlets, Water management (Applied), Canals, Channels, Ditches, Levees, Diversion structures, Conduits, Water resources development, Water conservation, Compensation, Benefits, Cost-benefit theory, Irrigation water, Irrigation practices, Multiple-purpose projects.
Identifiers: *Federal-state cooperation, Penalties.

Drainage districts may be organized to reclaim by a system of drains, ditches, watercourses and levees wet or overflowed lands for agricultural or sanitary purposes. Procedures for organizing such districts are provided. Districts: (1) may construct or improve drains and ditches, tile drains, and natural water-courses as necessary; (2) may construct and operate works for the impoundment, diversion, flowage, and distribution of waters for beneficial use; (3) may make assessments, issue bonds, or contract with owners for the beneficial use of projects; and (6) may cooperate with federal projects where possible. Existing districts have the powers: (1) to take necessary measures for the prevention of erosion, floodwater and sediment damage; (2) to further the conservation, development, utilization and disposal of water; and (3) to adopt necessary regulations. Connecting districts must pay compensation for the use of another district's drain outlets. Procedures are established for crossing railroads with canals and for payment of damages. Injuring or impairing the usefulness of drains is a misdemeanor and punishable under the act. Water in drainage canals may be used for irrigation of farm lands so long as the primary purpose of the canals is not impaired. (Douberley-Florida)
W70-01772

POTOMAC RIVER COMPACT.

Va Code Ann secs 28.1-203, 28.1-203.1, 28.1-227 (1969).

Descriptors: *Virginia, *Maryland, *Interstate compacts, *Water resources development, Interstate commissions, Fish management, Commercial fish, Commercial fishing, Administrative agencies, Legislation, Legal aspects, Regulation, State governments, State jurisdiction, Grants, Permits, Shellfish, Investigations, Taxes, Tidal waters, Supervisory control (Power), Oysters, Clams.
Identifiers: Potomac River.

The purpose of the compact is to aid in conserving fishery resources in the tidewater portion of the Potomac River between Maryland and Virginia. The Potomac River Fisheries Commission is hereby created and is given jurisdiction over a specified geographical area encompasssing certain waters of the Potomac River. The Commission may reseed and replant oyster bars as necessary, regulate type and size of all species of finfish and shellfish that can be caught within its jurisdiction, conduct research related to fishery conservation, and regulate by license the persons who may take fish or shellfish and the equipment that may be used. The Commission is authorized to receive grants and contributions made for its general purposes. It may cooperate with other state agencies in carrying out its research. The Commission may impose inspection taxes on oysters taken from its jurisdiction. The statute contains provisions for review of Commission regulations and for enforcement of these regulations and associated state laws. Existing state laws and private rights shall remain in force, except as later altered by proper acts of the Commission. The Commission may regulate and tax the dredging of soft shell clams. (Kelly-Florida)
W70-01773

WATER PRIORITY RIGHTS AND THEIR EFFECT ON FARM PLANNING IN THE SAN CARLOS IRRIGATION AND DRAINAGE DISTRICT IN CENTRAL ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 03F.
W70-01814

THE GEOGRAPHICAL BACKGROUND OF THE JORDAN WATER DISPUTE,
For primary bibliographic entry see Field 06B.
W70-01833

TAKING ROAD MATERIALS FROM STREAMS, RIVERS, AND WATERCOURSES.

Va Code Ann sec 33-69 (Supp 1968).

Descriptors: *Virginia, *Road construction, *Construction materials, *River beds, Legislation, Highways, Roadbanks, Rivers, Streams, Streambeds, Beds, Ownership of beds, Rocks, Gravels, Sands, Eminent domain, Condemnation, Easements, Right-of-way.

Before removing materials from streams, rivers, or watercourses for use on public roads, the State Highway Commissioner must submit a plan for removal to the Marine Resources Commission. After receiving the concurrence of the Commission of Fisheries, the Commissioner may take materials from watercourses, the beds of which are owned by the state. He may acquire by condemnation all property, rights, and easements necessary to obtain and use such materials. (Douberley-Florida)
W70-01914

INDIAN HUNTING AND FISHING RIGHTS.
Geo Wash L Rev, Vol 32, No 3, p 504-532, Mar 1964. 29 p, 139 ref.

Descriptors: *Fishing, *Hunting, *Relative rights, *Federal government, Water utilization, State governments, Ownership of beds, Water rights, Land tenure, Permits, Judicial decisions, Riparian land, Riparian rights, Grants, Legal aspects, Wildlife conservation, Condemnation, Compensation.
Identifiers: Indian reservations.

The ownership of a reservation by an Indian tribe carries with it the right to hunt and fish within the reservation. The beds of waters adjacent to an Indian reservation may be construed to be included within the reservation regardless of an absence of express grant; this is contrary to normal conveyance of riparian land by the United States in that conveyance of submerged beds usually must be express. Indian tribes have obtained additional hunting and fishing rights through express treaty grants and where reservations do not exist, through their status as aboriginal users. Normally such rights are tribally owned and cannot be taken by the government without just compensation. After reviewing cases concerning attempted federal and state regulation of Indian hunting and fishing rights, the author concludes that three schools exist: that the Indians need not be licensed, but their rights are not superior to those of any private person; that the government can regulate Indian rights only to the extent that adequate conservation cannot be achieved by any other means; and that Indian hunting and fishing rights are not subject to state regulation. The author favors the second school. (Kelly-Florida)
W70-01930

PORT MANAGEMENT GENERALLY.

Va Code Ann sec 62.1-163, 1968.

Descriptors: *Virginia, *Port authorities, *Harbors, *Local governments, Industries, Administration, Legislation, Management, Cities, Compensation, Salaries, Administrative agencies, Legal aspects, Regulation, Jurisdiction, State jurisdiction, Personnel, Employment.

The governing body of any city having a port may create such agencies, appoint such agents, and employ such persons as may be required for the orderly and effective management of such port and its harbor. The circuit court of the county of Northumberland shall appoint an agent for the port of Needville. The appointing authority may prescribe for such agents and agencies such terms of office, titles, authorities, duties, fees, and compensation not inconsistent with law as it may deem appropriate, and may require from each person so appointed a fidelity bond. All controversies arising between or among agents, agencies, authorities, or commissions of two or more ports shall be referred to the Virginia State Ports Authority which shall resolve every such controversy in the best interests of the Commonwealth as a whole. Any party thereto shall have a right of appeal to the Supreme Court of Appeals. (Schram-Florida)
W70-01940

JURISDICTION AND OWNERSHIP OF COMMONWEALTH OVER OFFSHORE WATERS AND LANDS.
Va Code Ann sec 7.1-2 (1966).

Descriptors: *Virginia, *State jurisdiction, *Beds, *Oceans, Coasts, Legislation, International law, Federal jurisdiction, Legal aspects, Treaties, Boundaries, Ownership of beds, Seashores, International waters, Water law, Political aspects.
Identifiers: *Offshore waters.

The jurisdiction of this state extends to and over waters offshore from the coasts of this state as follows: (1) the marginal sea to its outermost limits as said limits may from time to time be defined or recognized by the United States by international treaty or otherwise; (2) the high seas to whatever extent jurisdiction therein may be claimed by the United States or to whatever extent recognized by the usages and customs of international law; and (3) all submerged lands, including the subsurface thereof, lying under said waters. The ownership of said waters and lands shall be in this state unless conveyed by instrument or operation of law. This shall not operate to impair the legislative jurisdiction by the United States over any area validly ceded by the state. Nothing in this section alters the geographic area to which any statute of this state applies if such statute specifies such area precisely in miles or by some other numerical designation of distance or position. No other statute, however, shall waive or relinquish the jurisdiction or ownership established herein. (Schram-Florida)
W70-01975

BOUNDARY LINE BETWEEN VIRGINIA AND DISTRICT OF COLUMBIA.

Va Code Ann sec 7.1-10 (1966), as amended, (Supp 1968).

Descriptors: *Virginia, *District of Columbia, *Boundaries (Property), *State jurisdiction, Federal jurisdiction, Surveys, Erosion, High water mark, Legislation, Legal aspects, State governments, Landfills, Excavation, Taxes, Oil, Channels, Tributaries.
Identifiers: Coast and geodetic survey.

Pursuant to several federal acts, the boundary line between the District of Columbia and Virginia is established and declared to be binding by the State of Virginia. Said boundary line is described in detail. Concurrent jurisdiction over certain areas is established. The United States Coast and Geodetic Survey is authorized to survey and mark said boundary line. The boundary line begins at a point where the northwest boundary of the District of Columbia intercepts the high-water mark on the Virginia shore of the Potomac and follows the present mean high-water mark. Whenever said high-water mark on the Virginia shore is altered by fills, excavations, alluvion, or erosion, the boundary shall follow the new mean high-water mark. Whenever the location of the pierhead line along the Alexandria waterfront is altered, the boundary follows the new location of the pierhead line. (Schram-Florida)
W70-01982

RIGHT OF RAILROADS TO OCCUPANCY OF PASS OR DEFILE AND TO CROSS WATERCOURSES.

Va Code Ann secs 56-359, 56-362 (1969).

Descriptors: *Virginia, *Railroads, *Valleys, *Bridges, Legislation, Channels, Streams, Rivers, Navigable waters, Canals, Navigation, Navigable rivers.

No railroad company having a right to construct its road through any narrow defile of any creek or river valley shall have the right to exclusive occupance of such defile. When a railroad line is so located, no other railroad company shall obstruct the line first constructed, but it may be necessary to allow other companies use of the line. A railway may cross any canal, navigable stream, or watercourse, but not so as to unreasonably impede the navigation or use thereof. (Douberley-Florida)
W70-01992

SHORE DEVELOPMENT AND PRESERVATION.
R I Gen Laws Ann secs 46-3-2 thru 46-3-6 (1956), as amended, (Supp 1968).

Descriptors: *Rhode Island, *Beach erosion, *Shore protection, Coastal structures, Coastal engineering, Harbors, Ocean waves, Waves (Water), Beaches, Real property, Local governments, Coasts, Shore-line cover, Surf, Tides, Storms, Rivers, Investigations, Legislation, Legal aspects, Erosion control, Financing, Shores.
Identifiers: Storm damage.

The legislature intends to assist municipalities, by cooperative means, in protecting and preserving beach areas which are vulnerable to storm damage from erosion and damage from the elements. The Division of Harbors and Rivers is designated as the shore erosion authority for the state for the purpose of cooperating with the federal government. The Division shall conduct investigations of the state's shore line, harbors, and rivers and shall devise economical and effective methods and works for preventing and correcting beach erosion and resulting damage to public and private property. Open beach areas subject to loss of material through high waves or strong currents or beach areas vulnerable to storm damage because of geographical location are classed as exposed beach areas. Limits of the areas are in geographical, not political, terms. The Division of Harbors and Rivers within the State Department of Public Works, upon municipal application, provides two-thirds of the cost of acquisition of exposed beach areas. (Kelly-Florida)
W70-01997

FINANCING AND ACQUIRING LAND FOR BEACH EROSION CONTROL.

R I Gen Laws Ann secs 46-3-11 thru 46-3-18, 43-3-20, (1956), as amended, (Supp 1968)

Descriptors: *Rhode Island, *Beach erosion, *Financing, *Shore protection, Land tenure, Local governments, Harbors, Rivers, Construction costs, Coastal structures, Shore-line cover, Tides, Cost sharing, Administration, Cost repayment, Project planning, Compensation, Cost allocation, Legislation, Legal aspects, Erosion control.

Bonds may be issued by a municipality for the purpose of financing its share of the cost of acquiring land and of constructing or installing structures approved for the control of beach erosion. The municipality may secure repayment of such construction costs by assessments against property benefited. The assessments are made against property specially benefited by the construction of erosion control works and are made proportionately among affected landowners. All land is acquired in the name of the state. Payment therefor is made by the state, subject to municipal reimbursement. Title to the land is then transferred to the municipality, and the land is dedicated to the public

use. The Chief of the Division of Harbors and Rivers represents the state in dealing with the federal government in regard to financial assistance for beach erosion control works. (Kelly-Florida)
W70-01998

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W70-02002

WEATHER MODIFICATION: LAW AND ADMINISTRATION,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 03B.
W70-02028

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION OF YELLOWSTONE RIVER: VOLUME 1 - BILLINGS METROPOLITAN REGION, MONTANA,
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 04A.
W70-01681

FLOOD PLAIN INFORMATION, KENAI RIVER, ALASKA.
Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 04A.
W70-01682

FLOOD PLAIN INFORMATION, SHENANDOAH RIVER, CLARKE COUNTY, VIRGINIA.
Corps of Engineers, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W70-01683

REGIONAL CONSIDERATION OF FLOOD PLAIN PLANNING,
Bi-State Metropolitan Planning Commission for Scott County, Iowa and Rock Island County, Ill.
For primary bibliographic entry see Field 06B.
W70-01837

TECHNIQUES FOR DEVELOPING A COMPREHENSIVE PROGRAM FOR FLOOD PLAIN MANAGEMENT,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 06B.
W70-01838

MAN SHOULD MANAGE THE FLOOD PLAINS,
For primary bibliographic entry see Field 06B.
W70-01839

6G. Ecologic Impact of Water Development

MAN AND NATURE AT ODDS IN THE DELTA,
Louisiana State Univ., Baton Rouge.
Joseph D. Martinez, and Clarence O. Durham, Jr.
Environ Sci and Technol, Vol 3, No 12, p 1252-1257, Dec 1969. 6 p, 8 fig, 4 photo, 5 ref.

Descriptors: *Mississippi River, *River training, *Flood control, *Environmental effects, Ecology, Environment, Social aspects, Legal aspects, Geomorphology, Habitats, Hydrology, Wetlands.
Identifiers: *Mississippi River channel changes.

The history of the effects of management and control of the Mississippi River channel is briefly reviewed. A general principle to consider in modifying, regulating, or controlling large-scale geologic features or processes is to use the natural forces, so far as possible, to create a desired effect. For example: It is a natural tendency for a river like the Mississippi to meander. Attempts to rigidly maintain the position of its channel by the use of such controls as levees and revetments pit the engineer against the natural forces of the river. Cutoffs, spillways, newly constructed distributaries, and other similar works are compatible with natural morphological changes, however, and use the natural forces to advantage. The need for special consideration of regional factors in environmental planning and management is stressed. Such things as sociological and political characteristics and influences must be considered. (Knapp-USGS)
W70-01642

WATER POLLUTION IN ALASKA: PRESENT AND FUTURE,
Federal Water Pollution Control Administration, College, Alaska, Water Lab.
For primary bibliographic entry see Field 05B.
W70-01879

07. RESOURCES DATA

7A. Network Design

A NOTE ON RANDOM RAIN-GAUGE ERRORS,
Otago Univ., Dunedin (New Zealand).
P. Hutchinson.
J Hydrol (New Zeal), Vol 8, No 1, p 8-10, 1969. 3 p, 1 fig, 1 tab, 1 ref.

Descriptors: *Rain gages, *Calibrations, *Statistical methods, Data collections, Estimating, Quality control, Sampling, Measurement.
Identifiers: New Zealand, Rain gage error.

By using 12 standard rain gages on a small site, the random errors of rain-gage measurements were assessed both for individual storms and for monthly totals. It is shown that random errors can be considerable even without taking into account known systematic errors. For individual storms, the standard deviation increases with the mean rainfall value for the 12 gages, while the coefficient of variation is independent of the mean. The monthly values for the three months studied have standard deviations of the same order as the individual storms, but with lower--almost negligible--coefficients of variation. (Knapp-USGS)
W70-01693

7B. Data Acquisition

RESOLVING TIME, MASS ABSORPTION COEFFICIENT AND WATER CONTENT WITH GAMMA-RAY ATTENUATION,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 02G.
W70-01652

EVALUATING THE USE OF Na, Ca, AND DIVALENT CATION ELECTRODES IN SOME SOIL EXTRACTING SOLUTIONS,
Hawaii Inst. of Geophysics, Honolulu.
For primary bibliographic entry see Field 02G.
W70-01653

CONDUCTIVITY INSTRUMENTATION FOR IN SITU MEASUREMENT OF SOIL SALINITY,
Burr-Brown Research Corp., Tucson, Ariz.; and Arizona Univ., Tucson.
For primary bibliographic entry see Field 02G.
W70-01657

HYDRODYNAMIC STUDIES FOR ELECTRODIALYSIS,
McDonnell Douglas Astronautics Co., Newport Beach, Calif.
For primary bibliographic entry see Field 03A.
W70-01672

THE RECENT HISTORY OF THE INDUS,
Hunting Technical Services Ltd., Boreham Wood (England).
D. A. Holmes.
Geographical Journal, Vol 134, No 3, p 367-382, 1968. 5 fig, 12 ref.

Descriptors: *Mapping, *Aerial photography, *History, *Rivers, *Hydrography, Topography, Soil surveys, Arid climates, Channels.
Identifiers: *Indus River, *West Pakistan.

The author discusses evidence available from aerial photo interpretation as to probable courses over the past 2,000 years of the Indus River through the former province of Sind, West Pakistan, located in the western Thar Desert. The photo technique was found particularly useful in such an arid zone where alluvial patterns are not quickly changed by vegetation and soil formation processes. Maps are presented showing the present course and probable former courses. Changes since the 18th century are well documented. Probable locations and effects on current settlements are discussed for the historical periods of Greek, Arab, and Muslim occupation. Over the centuries the coastline has shifted many miles southward and into the Arabian Sea. Chronology of the different courses has also proven useful in understanding distribution of soils and non-saline ground water suitable for irrigation. (Crouse-Arizona)
W70-01804

THEORY AND EXPERIMENT IN CANAL SEEPAGE ESTIMATION USING RADIOISOTOPES,
Bhabha Atomic Research Center, Bombay (India). Isotope Div.
For primary bibliographic entry see Field 02G.
W70-01858

THE USE OF SCHLUMBERGER AND EQUATORIAL SOUNDINGS IN GROUNDWATER INVESTIGATIONS NEAR EL PASO, TEXAS,
Geological Survey, Denver, Colo.
Adel R. Zohdy.
Geophysics, Vol 34, No 5, p 713-728, Oct 1969. 16 p, 11 fig, 30 ref.

Descriptors: *Electrical studies, *Geophysics, *Exploration, *Groundwater, *Subsurface investigations, Surveys, Seismic studies, Texas, Electrical resistance, Instrumentation, Permeability, Aquifers, Water quality, Saline water-freshwater interfaces, Aquicludes.
Identifiers: Groundwater prospecting, Electrical soundings.

Electrical soundings using the symmetric AMNB Schlumberger and the bipole-dipole equatorial arrays were made along 2 profiles near El Paso, Texas, in support of a groundwater exploration program which included seismic refraction and gravity surveys. Electrode spacings reaching 12,000 ft allowed exploration to depths of about 7000 ft. Geoelectrical information on the subsurface materials was augmented by sounding with the bilateral equatorial configuration and by transforming Schlumberger curves into dipole-polar sounding curves. The bilateral equatorial sounding curves were useful for detecting the direction of dip of highly resistive bedrocks whereas transformed sounding curves were used to evaluate the average longitudinal resistivity and depth, to the 'electric basement.' The interpretation of distorted sounding curves illustrates the need for careful analysis in processing electrical prospecting data obtained in complex geologic conditions. The interpretation of a combined Schlumberger-equatorial sounding curve, which did not agree with seismic refraction data, was shown to be correct by data from a test well drilled to a depth of 4363 ft. Information was collected on the depth to fresh-water-salt-water interfaces and on the depth to highly resistive impervious bedrocks. (Knapp-USGS)
W70-01859

OPTIMIZING SEDIMENT SAMPLING PLANS,
Washington Univ., Seattle. Dept. of Oceanography.
J. C. Kelley, and D. A. McManus.
Marine Geol, Vol 7, No 5, p 465-471, Oct 1969. 7 p, 2 fig, 1 tab, 13 ref. Contract NONR-477 (37), Prog NR 083 012, ONR Contract AT (45-1)-1725 (Ref RLO-1725-125) AEC.

Descriptors: *Sampling, *Sediments, *Optimization, Statistical methods, Probability, Test procedures, Dredging, Particle size, Sedimentology, Marine geology.
Identifiers: Sampling optimization.

Sediment sampling at sea is a costly undertaking and inefficiency and redundancy must be minimized. Conversely, it is essential that the sampling density is high enough to obtain sufficiently reliable estimates of the variables of interest. In order to formalize these goals, an analysis of nine textural variables measured on samples from 450 stations on the continental shelf was made. A criterion for sufficient reliability was determined and optimal sampling plans were derived on the basis of this criterion. In an example of the analysis on one of the variables, mean phi size, the results indicate that even with optimal allocation of effort, much more extensive sampling is required for the resolution usually sought. (Knapp-USGS)
W70-01870

AERIAL INFRARED SURVEYS AT THE GEYSERS GEOTHERMAL STEAM FIELD, CALIFORNIA,
Geological Survey, Washington, D.C.
R. M. Moxham.
In: Geol Surv Res 1969, Prof Pap 650-C, p C106-C122, 1969. 17 p, 16 fig, 2 tab, 11 ref.

Descriptors: *Steam, *Thermal springs, *California, *Geothermal studies, *Infrared radiation, Aerial photography, Remote sensing, Thermal radiation, Heat flow, Temperature, Thermal conductivity.
Identifiers: *Steam wells, *Geysers Geothermal Area (Calif), Infrared photography.

An infrared radiance pattern on aerial infrared images of The Geysers area extends beyond the present (1968) northwest limit of steam production, and suggests slightly elevated surface temperatures. The radiance zone seems to coincide in part with a mapped fault, across which a surface temperature difference was measured. The principal high-temperature zones are bounded at the surface on the southwest by thermal lineaments, suggesting some corresponding structural control. The abnormal radiance at The Geysers is restricted to hydrothermal alteration zones and other local features. No evidence was found of a regional geothermal anomaly at the surface in The Geysers area, within the detection limit of the equipment used in this survey. (Knapp-USGS)
W70-01894

COMPARATIVE RESULTS OF SEDIMENT SAMPLING WITH A SURFACE SAMPLER AND DEPTH-INTEGRATING SAMPLERS,
Geological Survey, Austin, Tex.
Clarence T. Welborn.
In: Geol Surv Res 1969, Prof Pap 650-C, p C184-C187, 1969. 4 p, 6 fig, 4 ref.

Descriptors: *Sediment load, *Sampling, *Equipment, *Data processing, *Calibrations, Bed load, Suspended load, Sediment transport, Statistical methods.
Identifiers: Depth-integrating sediment samplers, Surface sediment samplers.

An investigation was made to determine the possibility of correlating sediment data from samples collected with a surface sampler with data from samples collected with depth-integrating samplers. A coefficient can be computed for sediment concentrations collected with a surface sampler from streams that carry small amounts of sand. It was not possible to compute a single coefficient that could be applied to the samples collected with a surface sampler from streams carrying a significant sand load. (Knapp-USGS)
W70-01897

FLOW-THROUGH SAMPLING SYSTEM FOR SMALL BOATS OR ICE SHELTER,
Geological Survey, Washington, D.C.; and Geological Survey, Fort Wayne, Ind.
John F. Ficke, and Robert G. Lipscomb.
In: Geol Surv Res 1969, Prof Pap 650-C, p C209-C211, 1969. 3 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Sampling, *Water quality, *Chemical analysis, Streams, Lakes, Instrumentation, Laboratory tests, Water analysis.
Identifiers: Flow-through sampling system.

A simple pumping sampler and flow-through system have been assembled for making rapid nonrecording temperature, conductance, dissolved-oxygen, and pH measurements on lakes. The set of observations at a point can be completed in about 3 minutes. Measurements to a depth of 30 meters can be made from a small boat or a portable ice shelter. Tests show that the pumping system does not affect the concentration of dissolved gases in the water. (Knapp-USGS)
W70-01900

SIMPLIFIED PUMPING SAMPLER FOR SUSPENDED SEDIMENT,
Geological Survey, Sacramento, Calif.
Benjamin L. Jones.
In: Geol Surv Res 1969, Prof Pap 650-C, p C212-C214, 1969. 3 p, 3 fig, 1 ref.

Descriptors: *Sampling, *Suspended load, Turbidity, Streams, Lakes, Instrumentation, Laboratory tests, Water analysis, Sediments.
Identifiers: Suspended sediment sampler.

A simplified pumping sampler was developed for the collection of suspended-sediment samples from streams. The sampler has a capacity of 20 containers, and the interval between samples can be varied from 2 minutes to several hundred hours. The sampler consists of a pump, electronic controls, and a bottling mechanism. The low initial cost, small size, and ease of installation of the device make it suitable for incorporation into present data-collection programs. (Knapp-USGS)
W70-01902

CARBON-14 DATES OF GROUND WATER FROM A PALEOZOIC CARBONATE AQUIFER, SOUTH-CENTRAL NEVADA,
Geological Survey, Denver, Colo.; and Geological Survey, Washington, D.C.
D. B. Grove, Meyer Rubin, B. B. Hanshaw, and W. A. Beetem.
In: Geol Surv Res 1969, Prof Pap 650-C, p C215-C218, 1969. 4 p, 1 fig, 1 tab, 5 ref.

Descriptors: *Radioactive dating, *Carbon radioisotopes, *Groundwater, *Carbonate rocks, *Nevada, Age, Groundwater movement, Sampling.
Identifiers: Carbon-14 groundwater dating.

Radiocarbon determinations were used to estimate the ages of groundwater from the Paleozoic aquifer underlying the Nevada Test Site and adjacent areas. A generally good correlation exists between the carbon-14 dates and the current hydraulic interpretations; but the aquifer is heterogeneous and is insufficiently defined to permit detailed predictions of groundwater velocities or flow patterns. (Knapp-USGS)
W70-01903

DETERMINATION OF THE BIOMASS OF AQUATIC PLANTS USING AN OPTICAL METHOD,
Water Pollution Research Lab., Stevenage (England).
M Owens, M. A. Learner, and P. J. Maris.
Journal of Ecology, Vol 55, No 3, p 671-676, 1967. 4 fig, 2 tab, 7 ref.

Descriptors: *Biomass, *On-site data collections, *Aquatic plants, *Optical properties, Weeds, Calibration, Herbicides, Density, Light intensity, Attenuation, Distribution patterns, Eutrophication, Lakes, Analytical techniques, Standing crop, Productivity, Light penetration.
Identifiers: Elodea canadensis, Berula erecta, Hippuris vulgaris, Callitriche, Ceratophyllum demersum, Myriophyllum, Potamogeton lucens, Potamogeton perfoliatus, Depth effects, Beds (Plants), Ranunculus pseudofluitans.

Cropping methods, used to determine the biomass of aquatic macrophytes, are tedious, particularly when the depth of water is so great that operations from a boat or by diving are necessary. Furthermore, it is sometimes desirable to determine biomass without removing the plants. A previously described method is applied by authors to determine quantitative distribution of aquatic plants by underwater light distributions. Vertical attenuation coefficients for several aquatic plants were determined in the field and compared with those obtained using laboratory procedures. Estimates of plant biomass obtained by cropping with those using this optical method agree closely. Three distribution patterns of biomass of plants at seasonal maximum are discernible. Berula and Hippuris are fairly uniformly distributed throughout the water column; Ranunculus and two Potamogeton species are near the surface, and greatest proportions of Ceratophyllum and Elodea are in the lower half of the column. A detailed study of herbicide application effects in an experimental lake, which contained biomass of Elodea canadensis, was determined on six dates by this optical method and could not have been accomplished using conventional cropping procedures. (Jones-Wisconsin)
W70-01931

USE OF MODIFIED DIURNAL CURVES FOR THE MEASUREMENT OF METABOLISM IN STANDING WATER,
Toronto Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W70-01941

7C. Evaluation, Processing and Publication

GEOLOGY AND GROUND WATER RESOURCES OF BURKE AND MOUNTRAIL COUNTIES: PART 2, GROUND WATER BASIC DATA,
Geological Survey, Washington, D.C.
C. A. Armstrong.
N Dak Geol Surv Bull 55 and N Dak State Water Comm County Ground Water Studies 14, 1969. 282 p, 2 fig, 2 plate, 5 tab, 13 ref.

Descriptors: *Data collections, *Hydrologic data, Water wells, Water quality, Aquifers, Water levels, Water table, Water yield.
Identifiers: Burke County (N Dak), Mountrail County (N Dak).

Basic data are compiled to use to determine the location, extent, and nature of aquifers, to evaluate groundwater occurrence and movement, to estimate potential well yields, and to determine water quality in Burke and Mountrail Counties, North Dakota. Tabulated data include information on 2100 wells, 58 springs, 63 observation wells, and 504 water chemical analyses. (Knapp-USGS)
W70-01684

THE ESTIMATION AND OCCURRENCE OF AGRICULTURAL DROUGHT,
Department of Agriculture, Ashburton (New Zealand). Winchmore Irrigation Research Station.
For primary bibliographic entry see Field 03F.
W70-01687

ESTIMATING COSTS OF AERIAL SURVEYS,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
Antonio M. Aguilar.
Civil Eng, Vol 39, No 10, p 70-73, Oct 1969. 4 p, 2 fig, 6 tab, 2 ref.

Descriptors: *Photogrammetry, *Surveys, *Mapping, *Cost analysis, *Estimated costs, Estimating, Forecasting, Aerial photography, Geological surveys, Photography, Terrain analysis.
Identifiers: Aerial photography costs.

Increasing numbers of project engineers without specialized training in photogrammetry are facing the task of preparing cost estimates of mapping projects. A need exists to provide those engineers with a simple but acceptable accurate cost estimating system. A system is described which renders accurate results for most of the mapping projects that an engineer faces, which is simple enough to compute the cost as a function of map scale, size of the area to be mapped and standardized mapping area conditions. Formulas, tables, and procedures are given to allow the engineer to estimate the maximum and minimum costs of an aerial survey. The system has been tested in 135 actual mapping projects prepared by six organizations, and in all cases predicted costs have been within an acceptable range of the actual costs. (Knapp-USGS)
W70-01698

OPTIMIZATION OF FLASH DISTILLATION PLANTS FOR SEA-WATER CONVERSION,
Haschinenfabrik Augsburg-Nuernberg A. G., Gustavsburg (West Germany).
B. Kunst.
Desalination 3, p 195-202, 1967. 9 fig, 2 ref.
Identifiers: *Computerized designs, *Economic evaluations, *Multistage flash distillation, Cost allocation, Dual-purpose plant, Energy costs, Product ratio, Programs (Computers).

To find an optimal solution for the design of a chemical process plant, all that is really required is an electronic computer of adequate size and speed and some detailed work which consists of disclosing the defining characteristics of the relevant function and in suitably controlling these. Unduly large programs, however, are difficult to handle and may not even be usable for lack of sufficient storage capacity and computing time. Hence, the planning of a plant must be carried out in two stages. In the first stage a series of optimum plant data is determined by means of a basic design procedure, an approximate estimation, and a minimum-seeking subprogram. In the second stage these data are used as initial values for the detailed design and cost estimation.
W70-01705

08. ENGINEERING WORKS

8A. Structures

SOME BASIC ASPECTS OF THE FLASH DISTILLATION PROCESS,
Heriot-Watt Univ., Edinburgh (Scotland).
For primary bibliographic entry see Field 03A.
W70-01712

EXERGY LOSSES IN A FLASH EVAPORATOR,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 03A.
W70-01713

DESIGN OF A 250-MGD VERTICAL-TUBE EVAPORATOR FOR SEAWATER DESALTING,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W70-01725

COUNTY PORT AUTHORITY.
For primary bibliographic entry see Field 06E.
W70-01762

THE ORIGIN AND SPREAD OF QANATS IN THE OLD WORLD,
Texas Univ., Austin, Tex.
For primary bibliographic entry see Field 04B
W70-01830

PAPER: (NAVIGABLE WATERWAYS BANK PROTECTION) (in French),
Behorde fuer Wirtschaft und Verkehr, Hamburg (West Germany).
For primary bibliographic entry see Field 06B
W70-01841

PAPER: (NAVIGABLE WATERWAY BANK PROTECTION) (IN FRENCH),
Ghent Rijksuniversiteit (Belgium).
For primary bibliographic entry see Field 06B.
W70-01842

THE ROVI REACTOR FOR DESALINATION OF SEA WATER - DESIGN AND INSTALLATION CRITERIA,
Montecatini Edison, Milan (Italy).
For primary bibliographic entry see Field 03A.
W70-01962

8B. Hydraulics

REVERSE AND DIRECT RESERVOIR ROUTING METHOD SETS HIGHWAY GRADE,
Ministry of Public Works, Caracas (Venezuela).
For primary bibliographic entry see Field 04C.
W70-01660

DIVERSION BY LAKE PIERCING, SNETTISHAM PROJECT,
Corps of Engineers, Anchorage, Alaska.
Thomas E. Munsey.
Civil Eng, Vol 39, No 10, p 48-52, Oct 1969. 5 p, 2 fig, 3 photo, 4 ref.

Descriptors: *Drainage, *Lakes, *Alaska, *Tunneling, *Diversion tunnels, Tunnels, Water levels, Tunnel hydraulics, Hydraulic structures, Tunnel design, Outlet works, Hydroelectric plants, Dams, Reservoir design, Reservoir construction.
Identifiers: Lake piercing.

The Norwegian method of lake piercing, well known throughout northern Europe, is being used in the Snettisham Project in southeastern Alaska to temporarily lower the water surface of a lake 130 ft below its natural level. After the surface drops, a power intake works will be constructed just above the low-water level, thus making 110,000 acre-ft of natural storage available for hydroelectric power production which would have been lost had a more conventional means of diversion been used. The method consists of driving a tunnel lakewards toward a point where an outlet is desired. A small rock plug is left to separate the tunnel and lake. After careful exploration and preparation, the plug is blasted through to drain the lake through the tunnel. A concrete plug will permanently stop flow in the tunnel when construction of the power works is completed. (Knapp-USGS)
W70-01661

HYDRODYNAMIC STUDIES FOR ELECTRODIALYSIS,
McDonnell Douglas Astronautics Co., Newport Beach, Calif.
For primary bibliographic entry see Field 03A.
W70-01672

DEVELOPMENT OF AN ANALYTICAL MODEL OF A FLASH STAGE - PART 1,
Connecticut Univ., Storrs.
C. H. Coogan, Jr., D. A. Fisher, F. W. Gilbert, and H. L. Ornstein.
OSW R and D Progr Rept No 364, July 1968. 69 p, 39 fig, 26 ref.
Identifiers: *Flash chambers, *Flow distribution, *Heat transfer, *Turbulent boundary layer, Development, Distillation processes, Evaporators, Flash evaporation, Flow distribution, Fluid dynamics, Fluid flow, Fluid mechanics, Heat balance, Thermodynamic analysis, Turbulence, Two phase flow, Weirs.

Model proposed consists of (1) The entrance jet region - wherein a submerged wall jet from the entrance orifice spreads vertically with recirculation above the jet. A high degree of turbulence causes large values of thermal conductivity in the vertical heat flow which evaporates the liquid at the free surface, (2) The central portion - wherein the velocity profile adjusts from a maximum at bottom to a maximum near the top, (3) The exit region - wherein the fluid is accelerated for entrance into the following stage. The major vertical heat transfer occurs in region (2). A typical boundary layer occurs at the channel bottom. Jet induced turbulence predominates. In region (2) at the liquid surface vapor is generated at the greatest rate. Turbulent thermal conductivity approximates 300,000 btu/hr ft deg F. Tentative relations for turbulent thermal conductivity are proposed. Fluctuations due to the turbulence is suggested as cause of large values of conductivity. Calculations based on AFM-CUNO Millstone Point laboratory test data.
W70-01723

STUDY OF TWO-PHASE METASTABLE FLOW,
Foster Wheeler Corp., Carteret, N.J.
For primary bibliographic entry see Field 03A.
W70-01753

DRAINAGE DESIGN THEORY AND PRACTICE,
Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experiment Unit.
For primary bibliographic entry see Field 02A.
W70-01877

HORIZONTAL JETS IN STAGNANT FLUID OF OTHER DENSITY,
Waterloopkundig Laboratorium, Delft (Netherlands).
Gerrit Abraham.
Journal of the Hydraulics Division, ASCE, Vol 91, No. HY4, Proc Paper 4411, p 139-154, July 1965. 16 ref, 6 fig.

Descriptors: *Jets, *Density, *Diffusion, Turbulence.
Identifiers: *Stagnant fluid.

The purpose was to study theoretically the influence of the density difference between a jet and the surrounding fluid on the diffusion caused by a circular horizontal submerged turbulent jet on the basis of the similarity principle. A theoretical solution is given on the basis of the assumption that the local variation of density in the jet is small in comparison with the density of the ambient fluid. Only three dimensional circular horizontal jets were considered in this study, and also only turbulent jets, so the influence of viscosity was not considered. Conclusions were: (1) The theoretical results show how the coordinates of the axis of the jet and the rate of mixing, and the velocity at the axis of the jet depend on the initial density difference between the jet and the stagnant ambient fluid and on the velocity of the jet when it issues from a nozzle. (2) The theoretical solution agrees fairly well with experimental data available in literature. (Guerrero-Vanderbilt)
W70-01912

TWO DIMENSIONAL REATTACHING JET FLOWS INCLUDING THE EFFECTS OF CURVATURE ON ENTRAINMENT,
Cambridge Univ. (England). Dept. of Engineering.
R. A. Sawyer.
Journal of Fluid Mechanics, Vol 17, Part 4, p 481-498, 1963. 8 fig, 16 ref.

Descriptors: *Jets, *Mixing, Diffusion.
Identifiers: *Entrainment, Recirculation.

The purpose of this study was to modify a previous analysis for predicting the average pressure and length of the region of recirculating flow enclosed by a low-speed turbulent jet, issuing parallel to a flat plate, taking into account the different rates of entrainment by the two edges of the curved jet, the initial mixing region and the pressure forces near reattachment. There is improved correlation between theory and experiment. The analysis was applied to the flow due to a jet emerging at an angle to a flat plate, and gives good prediction of the length and average pressure of the recirculation region for a particular value of an entrainment ratio parameter. Some conclusions were (1) A first order mixing length theory indicates that the effect of different entrainment rates at the two edges of a curved jet does not lead to jet velocity profiles that are substantially different from those of a plane jet. (2) Curvature was found to have a considerable effect on the entrainment properties of jets. (Guerrero-Vanderbilt)
W70-01917

THE DISPERSION OF MARKED FLUID IN TURBULENT SHEAR FLOW,
Cambridge Univ. (England). Cavendish Lab.
J. W. Elder.
Journal of Fluid Mechanics, Vol 5, Part 4, p 544-560, 1959. 7 fig, 14 ref.

Descriptors: *Open channels, *Diffusion, *Turbulent flow.
Identifiers: *Dispersion, *Marked fluid, Shear flow.

This paper describes the application of the analysis used by Taylor (1954) and based on the Reynolds analogy, to the case of the diffusion of marked fluid in turbulent flow in an open channel. The coefficient of longitudinal diffusion arising from the combined action of turbulent lateral diffusion and convection by the mean flow is computed to be 5.9 uh, where h is the depth of fluid and u the friction velocity. This is in agreement with the experiments carried out in the 14-inch water flume of the Engineering Laboratory, Cambridge. The working section was 10 feet long, rectangular in section and inclined at 0.046 deg to the horizontal. The experiments were limited to a depth of 1.0 to 1.5 cm, corresponding to a Reynolds number range of 2300 to 4500. The lateral diffusion coefficient was found by experiment to be 0.23 uh, which is three times larger than the value obtained by the assumption of isotrophy. The same analysis can be used to describe the longitudinal dispersion of discrete particles, both of zero buoyancy and of finite buoyancy, and comparison was made with observations by Batchelor, Binnie and Phillips (1955) and Binnie and Phillips (1958). (Guerrero-Vanderbilt)
W70-01919

MODEL SIMULATION OF VERTICAL MIXING IN STRATIFIED FLOWING WATER,
University of Strathclyde, Glasgow (Scotland).
D. I. H. Barr.
The Engineer, Vol 215, No 5587, p 345-352, Feb 22, 1963. 7 fig, 2 tab, 30 ref.

Descriptors: *Models studies, *Stratified flow, *Mixing, Thermal pollution.
Identifiers: *Heat dissipation.

A study of the basis of design of heat dissipation models was discussed. An empirical approach to the determination of the vertical exaggeration in such models was made, the basis of the method being the use of a Keulegan type congruency diagram for lock exchange flow in a wide channel. An introduction box with a fairing was fitted across a 1.5 ft wide plume to produce a thermally stratified flow in the flume downstream of the box with a depth controlled to be 0.625 ft using a downstream weir gate. The flows selected were 0.446, 0.223, 0.1115, 0.056, 0.0070 and 0.0167 cusecs. An in situ temperature measurement system based on thermopile was used. Small density differences were produced by temperature variations in the range from 60 deg F to 100 deg F. A 4.5 inch wide flume was also used as a quarter scale model of the larger flume. Conclusions were: (a) In some cases involving flowing water, the internal differential movements are dominant and the standard Froude criterion need not be applied strictly. (b) The hydraulics Research Station's method (1960) of determining exaggeration in heat dissipation models is thought to be dangerous. (c) When the congruency diagram for lock exchange underflow in a wide channel is extended, more accurate assessments of vertical exaggeration will be possible. (d) The possible effect of weather conditions has been neglected and the effects should be investigated. (Guerrero-Vanderbilt)
W70-01920

THE BUOYANT MOTION WITHIN A HOT GAS PLUME IN A HORIZONTAL WIND,
Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.
G. T. Csanady.
Journal of Fluid Mechanics, Vol 22, Part 2, p 225-239, 1965. 4 fig, 20 ref.

Descriptors: *Winds, *Buoyancy, *Turbulence.
Identifiers: *Smoke plume, *Rayleigh number.

The purpose of this study was to elucidate the behavior of a buoyant mass of fluid, injected at a constant rate into a moderately strong horizontal wind. A smoke plume that has become nearly horizontal at some distance from the source, behaves much like a 'line thermal,' for which, using a perturbation method, a solution in laminar flow may be obtained, on the supposition that excess temperatures are small and buoyant movements slow, i.e. that the Rayleigh number of the problem is suitably low. In analogy with some other problems in turbulent flow and in turbulent diffusion, the laminar solution is then assumed to approximate what is observed in the turbulent case, provided that the rate of growth of the diffusing cloud is assessed realistically. The so-calculated pattern of streamlines in a cross section of the plume agrees qualitatively with the observed behavior of hot plumes and puffs, consisting of two vortex-like structures of opposite sense of rotation, lying on either side of the plume center. The bodily upward movement of the plume is found to depend critically on the rate of growth of the plume. Thus, when the plume diameter grows faster than linearly with distance, the plume tends to reach an asymptotic height. The small Rayleigh number criterion restricts the validity of the solution to 'weakly buoyant' plumes. (Guerrero-Vanderbilt)
W70-01926

DIFFUSER DESIGN FOR DISCHARGE TO A STRATIFIED WATER,
Danish Isotope Center, Copenhagen.
For primary bibliographic entry see Field 05G.
W70-01928

8C. Hydraulic Machinery

COMBINED SYSTEM FOR THE OPTIMUM SATISFACTION OF SIMULTANEOUSLY ARISING DEMAND FOR FRESHWATER AND ELECTRICAL POWER,
Hoterv, Budapest (Hungary).
L. Heller, and L. Szucs.
Preprint of Paper SM-113/16 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 13 p, 9 fig.
Identifiers: *Dual-purpose plant economics, *Economic evaluations, Distillation processes, Dual-purpose plant, Flowsheets, Freeze processes, Membrane processes, Multistage flash distillation, Thermodynamics, Turbines.

In areas of low electric power demand, e.g., on islands and in underdeveloped countries, the advantages of back-pressure power generation are often not fully utilized. A solution presented here is to use the unsaleable energy for desalting of seawater by processes requiring this type of energy (heat pump, freezing, electrodialysis, etc.). A method is presented by which the optimum combination of processes and equipment can be selected to supply the demand for fresh water and electricity in any given area under any established conditions. In some combined processes the generated mechanical-type energy can be used for desalting equipment directly without electric or other coupling, thereby lowering fresh water costs. The combined system makes possible full use of electric power capacity in low-load periods, producing storable fresh water. Several examples are given to illustrate this point. Multiflash and heat-pump combinations, especially multiflash and injector-type heat-pump combinations, are treated in detail.
W70-01708

THE CHARACTERISTICS OF DUAL PROCESS DISTILLATION PLANT COMBINING VAPOUR COMPRESSION AND MULTI-STAGE FLASH EVAPORATORS,
Atomic Energy Research Establishment, Winfrith (England).
For primary bibliographic entry see Field 03A.
W70-01710

THE STEAM-GENERATING HEAVY-WATER REACTOR IN DUAL-PURPOSE APPLICATIONS,
Atomic Energy Research Establishment, Winfrith (England).
S. Chambers.
Preprint of Paper SM-113/45 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 9 p, 4 fig, 5 ref.
Identifiers: *Dual-purpose plant, *Multistage flash distillation, *Nuclear energy sources, *Programs (Computers),Capitalized costs, Computerized designs, Energy sources, Feasibility study, Heavy-water/Boiling-light-water reactors, Water costs estimate, 0-50 MGD plant, 51-250 MGD plant.

Two separate computer programs were used to study the SGHWR in dual-purpose systems and cross-tube multistage flash evaporation plants. One program calculates the steam cycle flowsheet and uses the performance ratio in a costing routine for the reactor and evaporator. The other calculates the detailed flowsheet and plant geometry of a multistage flash plant and performs a thorough commercial costing. The computer programs themselves are not given. Systems were studied over a range of water outputs of 60 to 240 mgd and a range of net electrical outputs from 100 to 400 mw. Optimization was done of the basis of minimum total operating cost and the water costs were calculated based on a power credit appropriate to an equivalent single-purpose power-only plant. It is seen that the SGHWR is capable of achieving a production ratio in excess of 0.5 mgal/mwd when used in conjunction with a multistage flash evaporation plant with present technology. Estimated water costs at a load factor of 90% and 10% for range from 33 to 36 cents/1000 gal. Acid treatment of the feedwater adds about 2.9 cents/1000 gal to these costs.
W70-01711

GAS-TURBINE AND DIESEL-DRIVEN VAPOR-COMPRESSION DESALTING PLANTS,
Oak Ridge National Lab., Tenn.; and Office of Saline Water, Washington, D.C.
S. J. Senatore, and P. G. Tomalin.
IN Proc Western Water Power Symp, Los Angeles, Apr 1968. Western Periodicals, North Hollywood, Calif, 1968. p c-33-43, 2 fig, 4 ref.
Identifiers: *Gas turbines, *Multistage flash distillation, *Single-purpose plant, *Vapor compression evaporation, *Vertical tube evaporators, Distillation processes, Fixed charge rate, Flash evaporation, Single-purpose plant economics, Turbines, Vapor compressors, Water costs estimate, 0-50 MGD Plant.

A study was conducted at ORNL to determine the economic potential of a gas-turbine or diesel-engine drive for a vapor compressor and a vertical tube evaporator VTE for desalting seawater in the 1- to 10-mgd range. Commercial components were used for a 2-mgd diesel-driven plant and for a 5.7-mgd plant with a gas-turbine drive. The diesel-engine and gas-turbine drives for the vapor-compression, VTE concepts were found to have good potential for reducing distillation costs in water-only plants, with diesel engines most effective in the 1- to 5-mgd range. In the 5- to 10-mgd range, the gas-turbine-driven concept becomes attractive, with 20 of the fuel energy used in the vertical tube effects and 56 in the MSF evaporator. Water cost of the 2-mgd diesel-powered plant with 32/mbtu natural gas fuel is estimated at 65 cents/1000 gal, based on a fixed charge rate of 5.8. Corresponding water cost for a gas-turbine 5.7-mgd water-only plant is 57 cents/1000 gal. The advantage of the vapor-conpression, VTE system is in its economies of 25 lb product/1000 btu fuel without the necessity of using high brine temperatures or very low temperature differences. The engine drive is more economical than an electric drive because waste heat can be recovered efficiently.
W70-01724

RATIONALE FOR LOW-COST NUCLEAR HEAT AND ELECTRICITY,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W70-01946

INTEGRATING DUAL-PURPOSE PLANT FOR POWER AND WATER PRODUCTION INTO AN EXISTING ELECTRICITY SUPPLY SYSTEM,
Electro-Watt Engineering Services Ltd., Zurich (Switzerland).
For primary bibliographic entry see Field 03A.
W70-01948

COMBINATION OF HIGH-TEMPERATURE REACTOR WITH A CLOSED-CYCLE GAS TURBINE AND DESALINATION PLANT,
Gutehoffnungshuete Sterkrade A.G., Oberhausen (West Germany).
For primary bibliographic entry see Field 03A.
W70-01949

THE SODIUM-COOLED FAST BREEDER REACTOR AS A HEAT SOURCE FOR DESALINATION PLANTS,
Bechtel Corp., San Francisco, Calif.
For primary bibliographic entry see Field 03A.
W70-01950

PRESSURIZED-WATER REACTORS FOR NATURAL AND ENRICHED URANIUM,
Siemens A. G., Erlangen (West Germany).
For primary bibliographic entry see Field 03A.
W70-01952

TECHNICAL AND ECONOMIC ASPECTS OF MEDIUM-POWER PLANTS FOR THE COMBINED PRODUCTION OF ELECTRICAL POWER AND DESALINATED WATER, USING VULCAN REACTORS AND LTV UNITS (IN FRENCH),
Societe Belge pour l'Industrie Nucleaire, Brussels; and Universal Desalting Corp., New York.
For primary bibliographic entry see Field 03A.
W70-01953

ASPECTS IN DEVELOPING SEA WATER FLASH-DISTILLATION PLANT TO NUCLEAR-HEATED PLANT ON THE BASIS OF EXPERIENCE GAINED IN THE DESIGN, START-UP AND OPERATION OF SUCH INSTALLATIONS,
Atlas-Mak Maschinenbau G.m.b.H., Bremen (West Germany); and Fried-Krupp, Essen (West Germany). Zentralinstitut fuer Forschung und Entwicklung.
For primary bibliographic entry see Field 03A
W70-01954

OPTIMUM BRINE HEATER STEAM TEMPERATURE ON MSF EVAPORATOR COUPLED WITH FOSSIL AND NUCLEAR FUELED POWER PLANTS,
GHH-Man Technik, Essen (West Germany).
For primary bibliographic entry see Field 03A.
W70-01956

HOT BRINE ENERGY STORE,
Aktiebolaget Atomenergi, Stockholm (Sweden).
For primary bibliographic entry see Field 03A.
W70-01957

SOME FEATURES REQUIRED OF NUCLEAR REACTORS FOR DUAL-PURPOSE WATER/POWER PRODUCTION,
United Kingdom Atomic Energy Authority, Risley (England).
For primary bibliographic entry see Field 03A.
W70-01959

PROGRESS IN NUCLEAR POWER AND DESALINATION,
Southern California Edison Co., Los Angeles.
For primary bibliographic entry see Field 03A.
W70-01961

THE ECONOMIC DEVELOPMENT OF NUCLEAR DESALTING PLANTS IN WATER AND POWER SUPPLY SYSTEMS,
Hawaii Univ., Honolulu; and Calif. Univ., Los Angeles.
For primary bibliographic entry see Field 03A.
W70-01963

HEAT SUPPLY TO A DESALTING UNIT BY AN ORGANIC NUCLEAR SINGLE-PURPOSE REACTOR (IN ITALIAN),
Comitato Nazionale per l'Energia Nucleare, Rome (Italy); and Montecatini Edison, Milan (Italy).
For primary bibliographic entry see Field 03A.
W70-01964

OPTIMIZATION STUDY ON THE COUPLING OF A LOW TEMPERATURE ROVI REACTOR WITH A DESALTING PLANT,
Bari Univ. (Italy); and Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
For primary bibliographic entry see Field 03A.
W70-01965

THE FUTURE ROLE OF BREEDER REACTORS IN UTILITY PLANNING,
Westinghouse Electric Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 03A.
W70-01966

COMPARATIVE ECONOMICS OF LARGE FOSSIL-FUELED VERSUS NUCLEAR GENERATING STATIONS,
Niagara Mohawk Power Corp., Syracuse, N.Y.
For primary bibliographic entry see Field 03A.
W70-01967

BRINE-HEATER LEAKAGE CONTROL PROBLEMS IN LARGE POWER DESALTING PLANTS,
For primary bibliographic entry see Field 03A.
W70-01968

8E. Rock Mechanics and Geology

INCREMENTAL STRESS UNDER A TWO-DIMENSIONAL ARTIFICIAL LAKE,
Alberta Univ., Edmonton. Dept. of Physics.
D. I. Gough
Canadian J Earth Sci, Vol 6, No 5, p 1067-1075, Oct 1969. 9 p, 5 fig, 8 ref

Descriptors. *Reservoirs, *Loads (Forces), *Stress, *Computer programs, Reservoir design, Structural stability, Geophysics, Seismology, Stress analysis, Faults (Geology), Fractures (Geology).
Identifiers: Reservoir-load tectonics, Dam safety.

Seismic activity has been induced by loading and possibly lubrication of faults in rocks underlying several artificial lakes. Such evidence of failure justifies study of incremental stress distributions produced by the filling of artificial lakes. In this paper two-dimensional lakes are considered. Equations are derived giving the incremental stress components due to a side of a water-filled trough of polygonal section in the surface of an elastic half-space. A computer program based on these equations is described. Distributions of stress parameters are shown for lakes of rectangular and isosceles triangular sections, and for a two-dimensional approximation of a section of the lake forming behind the Bennett Dam on the Peace River, British Columbia. (Knapp-USGS)
W70-01679

8F. Concrete

PAPER: (NAVIGABLE WATERWAYS BANK PROTECTION) (in French),
Behorde fuer Wirtschaft und Verkehr, Hamburg (West Germany).
For primary bibliographic entry see Field 06B.
W70-01841

PAPER: (NAVIGABLE WATERWAY BANK PROTECTION) (IN FRENCH),
Ghent Rijksuniversiteit (Belgium).
For primary bibliographic entry see Field 06B.
W70-01842

8G. Materials

PREVENTIVE FOR SCALING AND CORROSION OF FLASH EVAPORATORS,
Tokyo Electric Power Corp. (Japan); Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
N. Noguchi, S. Sato, T. Imatake, T. Matsubara, and T. Hamada.
Preprint of Paper SM-113/12 Presented at IAEA Symp Nucl desalination, Madrid, Spain, Nov 18-22, 1968. 27 p, 8 fig, 6 ref.
Identifiers: *Corrosion control, *Heat transfer, *Operating experience, *Scale prevention, Corrosion, Corrosion problems, Corrosion tests, Feedwater treatment, Flash evaporation, Heat transfer improvements, Operational problems, Physical chemistry of scale, Scaling.

A 26,400 gpd flash evaporator pilot plant, designed and built to test its reliability in continuous operation, with particular attention to scaling and corrosion of heat transfer tubes and other equipment, has been in operation 7500 hrs. The experimental operation was carried out at temperatures up to 239 deg F, which is within the known solubility limits of calcium sulphate. Calcium carbonate and magnesium hydroxide scale were satisfactorily prevented by ph control. Data obtained on corrosion resistance of materials used in polluted seawater are (1) the variation in the characteristics of a pilot plant in relation to operating hours at various test conditions, (2) chemical composition of scale deposits at test conditions, i.e., top temperatures of 203 deg F to 239 deg F, mean ph values of 7.0 and 7.8 and concentration factor of 2.0, (3) the tendency of corrosion resistance in such materials as 90/10 cupronickel tubes, aluminum brass tubes, several ferric plates and steel plates coated with epoxy and rubber.
W70-01707

STUDY OF THE BEHAVIOUR OF VARIOUS MATERIALS IN SEA WATER UP TO 150 DEG C,
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
G. Boisde, H. Coriou, L. Grall, C. Mahieu, and M. Pelras.
Preprint of Paper 113/23 Presented at IAEA Symp Nucl Desalination, Madrid, Spain, Nov 18-22, 1968. 25 p, 22 fig, 11 ref.
Identifiers: *Coatings, *Corrosion problems, *Dezincification, *Pitting (Corrosion), Aluminum alloys, Aluminum brasses, Copper alloys, Corrosion, Corrosion control, Corrosion tests, Fabrication materials, Titanium.

The behavior of metals, alloys and non-metal linings, chiefly in synthetic seawater (ASTM standard) at temperatures ranging from 100 to 150 deg C was studied. The tests were carried out in static conditions with particular attention to various types of local corrosion. After 1000 hours at 150 deg C in the presence of air there was (1) formation of deep pitting and transgranular cracks from the pits, as in the case of very low-carbon stainless steels of the type cr 18%, ni 10%, and cr 17%, ni 13%, mo 2.7%, and (2) considerable corrosion due to the crevice effect in titanium samples kept in contact with teflon components. Comparative tests at 100-150 deg C in air and in a vacuum made possible the study of effect of temperature and oxygen content on the dezincification of naval brass and aluminum brass, on the de-aluminization of single-phase and two-phase copper-aluminums (in the work-hardened and annealed state) and on the corrosion of 90/10 and 70/30 copper nickels. Some 30 commercial linings used for soft steel were tested in the liquid and vapor phases of seawater at 100, 125 and 150 deg C. The behavior of an epoxy resin with a polyamine hardener proved very encouraging. Experimental equipment developed for dynamic corrosion tests in natural seawater or in chlorinated solutions at temperatures up to 150 deg C was described. (In French)
W70-01709

CONDENSER TUBE MATERIALS FOR SEA-WATER SERVICE,
Naval Ship Research and Development Lab., Annapolis, Md. Annapolis Div.
R. B. Niederberger.
J Eng Power 88, p 410-14, 1966. 1 fig, 2 tab, 8 ref.
Identifiers: *Condensers, *Fabrication materials, *Tubing (Metal), Aluminum, Copper alloys, Corrosion, Corrosion tests, Erosion corrosion, Nickel alloys, Stainless steels, Titanium.

The results of a series of investigations to assess the performance of a variety of alloys in small experimental condenser configurations at seawater velocities of 10 to 20 fps are summarized. They demonstrate that the addition of 1% aluminum increases the maximum velocity limits of copper-nickel alloys to 12-15 fps. Stainless steels, nickel alloys, and titanium are satisfactory for use at velocities of 20 fps, but many of these would be susceptible to pitting and/or crevice corrosion under stagnant conditions.
W70-01721

CUPRO NICKEL ALLOYS FOR DESALINATION PLANTS,
American Brass Co., Waterbury, Conn.
D. M. McCue.
IN Proc Western Water Power Symp, Los Angeles, Apr 1968. Western Periodicals, North Hollywood, Calif, 1968. p C-88-89.
Identifiers: *Copper alloys, *Fabrication materials, *Nickel alloys, *Specifications, *Tubing (Metal), Condensers, Copper, Corrosion, Corrosion control, Hydrostatics, Nickel, Pitting (Corrosion), Stress corrosion.

Because of their resistance to corrosion in seawater and to stress corrosion cracking, the cupro-nickel alloys (with a little iron added to control pitting) are used for tubing in leading desalting processes. Performance requirements are exacting for desalting in that a 30-yr service life is desirable, but the pressure to which the tubes are subjected is less than 100 psig, thereby differing from power plant tubing requirements. Another point of difference is in length. Currently the longest tube lengths in use in power plants are only about 100 ft, while the desalting program envisions tubes exceeding 300 ft. In view of these differences, the OSW in 1965 instituted at ORNL a task group (with representatives from industry, copper development association, OSW and other interested parties) to formulate a set of specs differing from those in ASTM specification B 111 for copper seamless condenser tubes. The resulting proposed specifications cover both 90-10 and 70-30 cupro-nickel alloy tubes and contain chemical requirements more complete than those in ASTM B 111 in that total carbon, phosphorus and sulfur are named. Minimum tensile properties are set at 65,000 psi for 70-30 cupro-nickel and 50,000 psi for 90-10 cupro-nickel. The new specs call for eddy current testing instead of hydrostatic testing, as under ASTM spec.
W70-01727

THE CUPRO-NICKELS IN DESALINATION PLANT,
International Nickel Co., Ltd., London (England); and International Nickel Co., Inc., New York.
B. A. Weldon, and A. H. Tuthill.
IN Proc Western Water Power Symp, Los Angeles, Apr 1968. Western Periodicals, North Hollywood, Calif, 1968. p C-90-103, 1 fig, 15 ref.
Identifiers: *Copper alloys, *Fabrication materials, *Nickel alloys, *Tubing (Metal), Condensers, Copper, Corrosion, Corrosion control, Nickel, Pitting (Corrosion), Reviews, Stress corrosion.

A brief review of the properties of the most important alloys of the copper-nickel series, showing how they have been used in the past and discussing their corrosion behavior with particular reference to operation in large desalination plants. The alloys CF copper and nickel show mutual solid solubility throughout the whole range of composition, and thus all of them are basically ductile and corrosion resistant. However, two alloys at the copper-rich end of the range (90/10 cuni and 70/30 cuni) and one at the nickel-rich end (70-30 nicu) have proved to be particularly useful for desalting plant application. They have already been used extensively for tubes in both large desalting plants and in shipboard evaporators, and it is probable that they will be the first choice for plants now being designed, especially for the stages where corrosion conditions are most aggressive and also in many cases throughout the plant where long life and low maintenance are a prime consideration.
W70-01728

INVESTIGATION OF CORROSION IN HOT SEA WATER IN AN EXPERIMENTAL LOOP APPARATUS,
Battelle Memorial Inst., Columbus, Ohio.
For primary bibliographic entry see Field 03A.
W70-01755

CORROSION-RESISTANT COATINGS FOR WASTEWATER TREATMENT PLANTS,
Koppers Co., Inc., Pittsburg, Pa. Organic Materials Div.
For primary bibliographic entry see Field 05D.
W70-01993

09. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

PROGRESS IN SPORT FISHERY RESEARCH - 1968.
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
Bur Sport Fish and Wildlife Resource Publication 77, May 1969. 259 p, 7 fig, 10 tab, 10 photo.

Descriptors: *Fisheries, *Sport fishing, *Ecology, Fish management, Fish conservation, Fish reproduction, Pesticides, Fish populations, Fish control agents, Reservoir fisheries, Stream fisheries, Marine fisheries, Lake fisheries.
Identifiers: *Sport fisheries research.

The research done in 1968 by the Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, is reviewed and summarized. Topics include ecosystem research, pesticide research, and fish husbandry research. A bibliography of work done by Bureau employees as well as translations and some reports by others is included. (Knapp-USGS)
W70-01883

10. SCIENTIFIC AND TECHNICAL INFORMATION

WATER AND LAND RESOURCES OF ARKANSAS,
Arkansas Soil and Water Conservation Commission, Little Rock.
Charles J. Finger.
Arkansas Soil and Water Conserv Comm Bibliogr Rep, June 1967. 90 p, 945 ref.

Descriptors: *Bibliographies, *Water resources, *Arkansas, Planning, Water management (Applied), Water resources development, Water pollution, Water supply, Groundwater, Surface waters, Water utilization, Climates, Drainage, Economics, Floods, Water chemistry, Aquifers, Irrigation, Land management, Limnology, Recreation, Water storage, Sedimentation, Soils.
Identifiers: Water resources bibliography.

As one of the first steps in the preparation of a comprehensive state water plan, the Arkansas Soil and Water Conservation Commission authorized the preparation of a bibliography of literature pertaining to water and related land resources of Arkansas. The material in the bibliography is arranged under subject-matter headings. Under each subject the material is listed alphabetically by author, from the earliest to the most recent date. Those references dealing with more than one subject are listed under the major subject and have not been cross-indexed. Many of the publications listed are available in a library maintained in the office of the Commission. (Knapp-USGS)
W70-01701

METROPOLITAN WATER RESOURCE MANAGEMENT AS AN EMERGING SPECIALIZED TECHNICAL AREA: A STATE-OF-THE-ART AND LITERATURE REVIEW,
Chicago Univ., Ill. Center for Urban Studies.
For primary bibliographic entry see Field 06B.
W70-01840

PROGRESS IN SPORT FISHERY RESEARCH - 1968.
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
For primary bibliographic entry see Field 09C.
W70-01883

STATISTICAL METHODS IN USING MARK-RECAPTURE DATA FOR POPULATION ESTIMATION.
Department of the Interior, Washington, D.C. Library.

US Dept of the Interior, Dept Library, Bibliography No 4, Nov 1967. 67 p, 288 ref. Tepper, Ester E (Compiler).

Descriptors: *Bibliographies, *Fish populations, *Statistical methods, Methodology, Animal populations, Marking techniques, Census, Sampling, Tagging, Analytical techniques, Estimating equa-

tions, Standing crop, Productivity, Fish, Fish management.
Identifiers: *Population estimation, Field studies, Experimental design.

Compiler has accumulated a partially annotated bibliography of the literature published through 1966, pertaining to estimation of animal populations using mark-recapture data. Entries are predominantly from North American and Western European literature, and are primarily concerned with fish populations. Subjects are catalogued as: Statistical Methods (83 references), Field Studies (103 references), Materials and Techniques (63 references), and General Reference Works (39 references). An author index is provided, no cross-indexing is included. (Voigtlander-Wisconsin)
W70-01937

OIL DISPERSING CHEMICALS, A STUDY OF THE COMPOSITION, PROPERTIES AND USE OF CHEMICALS FOR DISPERSING OIL SPILLS,
Federal Water Pollution Control Administration, Edison, N.J. Water Quality Lab
For primary bibliographic entry see Field 05G.
W70-02037

BIOLOGICAL EFFECTS OF OIL POLLUTION - BIBLIOGRAPHY, A COLLECTION OF REFERENCES CONCERNING THE EFFECTS OF OIL ON BIOLOGICAL SYSTEMS,
Federal Water Pollution Control Administration, Edison, N.J. Water Quality Lab.
For primary bibliographic entry see Field 05C.
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DEPARTMENT OF ENERGY, MINES AND RESOURCES, CALGARY (ALBERTA). INLAND WATERS BRANCH AND DEPARTMENT OF FISHERIES AND FORESTRY, CALGARY (ALBERTA). FORESTRY BRANCH.
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FISHERIES RESEARCH BOARD OF CANADA, ST. ANDREWS (NEW BRUNSWICK). BIOLOGICAL STATION.
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FISHERIES RESEARCH BOARD OF CANADA. MARINE ECOLOGY LAB. AND BEDFORD INST., DARTMOUTH (NOVA SCOTIA).
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GEOLOGICAL SURVEY, LAWRENCE, KAN. AND MINISTRY OF PUBLIC WORKS (CANARY ISLANDS).
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U.S. Geological Survey - Hydrology	W70-01642 -- 01672 01674 -- 01702 01853 -- 01911	119
Rutgers - The State University - Water Resources Economics	W70-01841 -- 01852 02004 -- 02025	34
University of Texas - Waste Water Treatment	W70-01969 -- 01974 01976 -- 01981 01983 -- 01991 01993, 02042	23
Cornell University - Policy Models for Water Resources Systems	W70-01763 -- 01768 01774 -- 01775	8
University of Washington - Water Quality Requirements for Acquatic Organisms	W70-01776 -- 01798 01994 -- 01996 01999 -- 02001 02003	30
University of Florida - Eastern U.S. Water Law	W70-01673, 01704, 01762, 01769, 01770, 01771, 01772, 01773, 01975, 01982, 01992, 01997, 01998, 02002	14
University of Arizona - Arid Lands Water Resources	W70-01799 -- 01836	38
University of Chicago - Metropolitan Water Resources Management	W70-01837 -- 01840 02026 -- 02036	15
Vanderbilt University - Thermal Pollution	W70-01912 -- 01930	19
University of Wisconsin - Eutrophication	W70-01931 -- 01945	15
B. Others:		
Oak Ridge National Laboratory	W70-01703, 01705 -- 01761 01946 -- 01957 01959 -- 01968	80
Federal Water Pollution Control Administration	W70-02037 -- 02039	3
Forest Service	W70-02040 -- 12041	2
	Total	400

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2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 3, NUMBER 6
MARCH 15, 1970

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 6
MARCH 15, 1970

W70-02043 -- W70-02442

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
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ABSTRACT SOURCES

02. WATER CYCLE

2A. General

EQUIVALENT DISTRIBUTIONS WITH APPLICATION TO RAINFALL AS AN UPPER BOUND TO FLOOD DISTRIBUTIONS,
Victoria State Rivers and Water Supply Commission (Australia).
G. N. Alexander, A. Karoly, and A. B. Susts.
J Hydrol, Vol 9, No 3, p 322-344, Nov 1969. 23 p, 5 fig, 2 tab, 24 ref.

Descriptors: *Floods, *Flood forecasting, *Mathematical studies, *Statistical models, Parametric hydrology, Rainfall-runoff relationships, Time series analysis, Regression analysis, Reviews, Hydrology, Frequency analysis, Probability.
Identifiers: *Australia, Flood distributions (Statistical).

The analysis of hydrologic variables for estimating the relation between magnitude and frequency of rare floods is discussed. A survey was made of the relatively unsuccessful search for the most appropriate distribution for floods and for rainfall by statistical examination of observations. It is shown that, using known hydrostatistical relationships between rainfall, losses and floods, the same distribution type cannot in practice be used over the complete range for both rainfall and floods. Location, scale and shape parameters and moment-ratios necessary for the complete description of floods and rainfall are discussed. The moment-ratio diagram is used to give a graphical measure of distribution types. The extreme-value and log-normal distribution are equivalent with a given geometric standard deviation. Methods are given for estimating location and scale parameters. Rainfall can be equally well represented by the log-normal and extreme value distributions even when extrapolated to return periods of 10000 years. (Knapp-USGS)
W70-02046

GLACIOLOGICAL RESEARCH IN NORWAY, 1968 (NORWEGIAN),
Norwegian Water Resources and Electricity Board, Oslo. Glaciology Section.
For primary bibliographic entry see Field 02C.
W70-02084

EVALUATION OF ERRORS PRESENT IN WATER BALANCE INVESTIGATIONS (RUSSIAN),
A. G. Bulavko.
Leningrad Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii No 7, p 3-13, 1967. 4 tab, 27 ref.

Descriptors: *Water balance, *Mathematical studies, *Estimating, Moisture availability, Moisture, Evaporation, River flow, Precipitation (Atmospheric), Rain, Drainage density, Runoff, Reservoir storage, Hydrologic properties, Drainage water, Floods, Lakes, Bogs, Forests, Snow, Snowmelt, Transpiration.
Identifiers: Water-balance errors, World hydrologic stations.

The magnitude and character of errors associated with water balance investigations were analyzed. The effects of precipitation, drainage, area, rain, riverflow, spring flood, snowmelt, and vegetation were analyzed and expressed in several tables. The errors in calculating basic elements of water balance can be up to 25%, with 10-15%, 15-20% and 20-25% in using monthly river flows, monthly drainage basin precipitations, and monthly evaporations, respectively. In general it is recommended that in evaluating water-balance concepts the determination of moisture-holding capacity of a river-drainage area should be the first and most important step, and evaporation should be calculated as the residual term. (Gabriel-USGS)
W70-02218

WATER BALANCE AND RUNOFF UNDER THE CONDITIONS OF SUBSURFACE KARSTIC ENVIRONMENT (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
O. L. Markova.
Leningrad Gosudarstvennyi Gidrologicheskii Inst, Sbornik po Gidrologii No 7, p 28-40, 1967. 13 p, 2 fig, 9 tab, 19 ref.

Descriptors: *Water balance, *Runoff, *Karst, River basins, Discharge (Water), Water loss, Evaporation, Precipitation (Atmospheric), Topography, Springs, Water utilization, Water supply, Groundwater gaging, Groundwater.
Identifiers: *USSR, East European Plain, Kama River basin, White Sea basin, Barentz Sea Basin, Volga River basin.

Hydrologic regimes of subsurface karstic and transkarstic regions of the USSR were investigated using hydrologic observations recorded from 1955 to 1965 in the basins of the White Sea, Barentz Sea, Volga River, Kama River, Dniester River, Ay River, and in the drainage basins of the Izhora and Pandiver uplands. The effect of karstic conditions cannot be investigated without taking into consideration the size of a drainage area and the character of interconnection existing between the surface and underground waters in the area under investigation. Moreover, the effect of karst on water balance and normal value of annual runoff is determined by the lack of coincidence between surface and subsurface boundaries of river drainage basins and in transkarstian basins of small dimensions. The balance between the inflow and outflow waters is often of negative character. (Gabriel-USGS)
W70-02219

INVESTIGATIONS OF THE RELATIONSHIP BETWEEN SURFACE WATERS AND FISSURE-KARSTIC GROUNDWATERS OF THE AY RIVER BASIN (RUSSIAN),
Institut po Proektirovaniiu Predpriiatii Nikelevoi Promyshlennosti, Leningrad (USSR).
P. V. Molitvin.
Leningrad Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot Po Gidrologii No 7, p 14-27, 1967. 14 p, 3 fig, 3 tab, 6 ref.

Descriptors: *Surface-groundwater relationships, *Groundwater, *River basins, *Karst, Fissures (Geology), Geology, Sandstones, Metamorphic rocks, Carbonate rocks, Water circulation, Fluorescence, Mining, Velocity, Water level fluctuations, Runoff, Gaging stations, Discharge (Water).
Identifiers: *USSR, Southern Urals.

Surface water-groundwater relationships were analyzed on the basis of geological and hydrological observations conducted in the Ay River basin of the Southern Urals from 1955 to 1965. Hydrologic observations consisting of the data recorded at the standard gage stations were supplemented by using a fluorescent tracer solution in the artificial canals connecting the mine shafts and tunnels of the area. The future development of mines in the Ay basin to full industrial capacity will induce the flooding of deep mines as a result of induced recharge of stream waters of the area by fissures and general karstic environment. (Gabriel-USGS)
W70-02220

SOME RELATIONSHIPS BETWEEN FIXED AND MEAN DAILY MAXIMUM DISCHARGES OF RAINFALL AND FLOODS IN THE BASIN OF THE UPPER VOLGA RIVER (RUSSIAN),
Hydrometeorological Service of the USSR, Moscow.
Ye. Sh. Azarkovich.
Leningrad Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii No 7, p 41-48, 1967. 8 p, 2 fig, 2 tab, 4 ref.

Descriptors: *Floods, *Discharge (Water), *Flood forecasting, Discharge measurements, Rain, Runoff, River basins, Hydrograph analysis, Precipitation (Atmospheric), Drainage, Topography, Geology, Soil properties.
Identifiers: *USSR, Volga River basin, Volga River discharge.

Experimental curves of transient coefficients K equals Df/Dmd, where Df is the fixed discharge and Dmd is the mean daily discharge, were analyzed and plotted on the basis of rainfall-flood data recorded during 1940 to 1956 in the upper reaches of the Volga River basin. The experimental curve of transient coefficients versus their drainage areas can be assumed to be of analytical value and should be used in the afforested areas of the Upper Volga River basin. Transient coefficients for the maximum rainfall and snowmelt discharges are quite similar giving 0.5 and 0.2-0.3 for drainage areas of less than 10 sq km and more than 10 sq km, respectively. (Gabriel-USGS)
W70-02221

ANALYSIS OF FORMING AND DETERMINATION OF RAINFALL-RUNOFF LOSSES IN EASTERN CARPATHIANS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
P. M. Lyutik.
Leningrad Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii No 7, p 60-75, 1967. 16 p, 7 fig, 2 tab, 15 ref.

Descriptors: *Rain, *Runoff, *Water loss, *Rainfall-runoff relationships, Floods, River basins, Precipitation (Atmospheric), Discharge (Water), Hydrologic properties, Drainage districts, Infiltration, Evaporation, Hydrograph analysis, Climatic zones, Storm runoff, Frequency.
Identifiers: *USSR, Carpathians, Rainfall-runoff loss, Surface runoff loss.

On the basis of discharge and precipitation data recorded at several gaging stations of the Carpathian Rivers, the rainfall-runoff losses were analyzed by using the standard technique of subdividing a river discharge into the total and basic parts. Flood frequencies, runoff coefficients, precipitation, and water loss volumes were calculated and expressed by charts and tables. The analysis of runoff coefficients indicates an initial loss of water equal to a layer of 40-50 mm in thickness for summer floods and 10-15 mm for spring and fall floods. The hydrologic data record at the Transcarpathian gaging station shows the greatest losses (as much as 90%) after isolated rainfalls in river basins of small areal extent. The smallest losses occur after long intensive rainfall or after a long rainfall period. The majority of rainfalls characterized by maximum discharges have high rainfall-coefficient values (0.60 - 0.90) and occur during the spring and fall months. (Gabriel-USGS)
W70-02222

DETERMINATION OF MAXIMUM DISCHARGES OF RAINFALL FLOODS IN THE EASTERN CARPATHIANS RIVERS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
P. M. Lyutik.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst., Sbornik Rabot po Gidrologin, No 7, p 76-84, 1967. 9 p, 1 fig, 1 tab, 15 ref.

Descriptors: *Floods, *Discharge (Water), *Rainfall-runoff relationships, *Flood forecasting, Precipitation (Atmospheric), Gaging stations, Rainfall, Water loss, River basins, Slopes, Velocity, River beds, Vegetation, Mathematical studies.
Identifiers: *USSR, Eastern Carpathians.

Analytical and experimental procedures are given for the analysis of maximum rainfall flood data recorded by several river gaging stations of the Eastern Carpathians. The mathematical analysis is based on the utilization of ultimate runoff formulas and precipitation reduction curves. The results of this study can be safely applied for the determination of rainfall flood discharges taking place in the Carpathian Rivers; however, the best results should be obtained in analyzing the maximum flood

discharges of drainage areas not exceeding 1000 sq km. Somewhat different reduction formulas are suggested for drainage areas exceeding 1000 sq km. (Gabriel-USGS)
W70-02223

METHODS FOR THE CALCULATION OF FLUCTUATIONS COEFFICIENTS OF SURFACE SPRING RUNOFFS FOR THE CONDITIONS REPRESENTED BY FOREST-STEPPE AND STEPPE ZONES OF THE EUROPEAN USSR (RUSSIAN),
Voronezh State Univ. (SSSR).
V. M. Mishon.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst., Sbornik Rabot po Gidrologii, No 7, p 85-91, 1967. 7 p, 4 fig, 1 tab.

Descriptors: *Mathematical studies, *Surface runoff, *Seasonal, *Vegetation, Discharge (Water), Hydrograph analysis, Forests, Water storage, River basins, Snowmelt, Evaporation, Infiltration, Physical properties, Water balance, Ice, Groundwater, Snow, Runoff coefficient.
Identifiers: *USSR, Forest-Steppe zones, Steppe zones.

Spring seasonal runoff was analyzed on the basis of Yunusov's coefficient-of-fluctuation method and hydrologic data recorded in the steppe and forest areas of the European USSR. By introducing additional complex parameters, mainly based on the physico-geographical conditions affecting runoff genesis, the values of the fluctuation coefficients and parameters were computed and plotted. Calculation of variation coefficients of spring discharges using the coefficients of internal annual-flow-nonuniformity and hydrograph curves is a reliable method. (Gabriel-USGS)
W70-02224

A MAP OF ANNUAL RUNOFF OF RIVERS OF THE ALAI AND TURKESTAN RANGES (RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Geografii.
A. O. Kemmerickh.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst., Sbornik Rabot po Gidrologii, No 7, p 92-96, 1967.

Descriptors: *Runoff, *River basins, *Discharge (Water), Drainage, Watersheds (Basins), Altitude, Slopes, Velocity, Gaging stations, Flow measurement, Hydrologic data, Maps.
Identifiers: *USSR, Alai Range, Kirgiz SSR, Turkestan Range.

The basic characteristics of drainage necessary for the evaluation of hydrologic constructions and water management in the Alai and Turkestan Ranges were analyzed. A map of annual river discharges as a function of altitude was constructed using the data from 41 hydrologic stations. The area can be subdivided into 4 basin range areas by discharges varying from 0.2 to 3.4 liter/sec/sq km for each 100 m of altitude. The greatest values are found in the upper reaches of the Zeravshan, Pitaukul, and Tamdykul Rivers. In general, the total annual discharges of the Alai and Turkestan Ranges is estimated to be 11.09 cu km or 11.9 liter/sec/sq km. (Gabriel-USGS)
W70-02225

MINIMUM RUNOFF OF ANGARA RIVER TRIBUTARIES (RUSSIAN),
All-Union Research Inst. of Water Supply, Drainage, Hydro-Engineering Works and Engineering Hydrogeology, Moscow (USSR).
For primary bibliographic entry see Field 02E.
W70-02226

DETERMINATION OF RAINFALL RUNOFFS USING PRECIPITATION AND MOISTURE CONTENT OF RUNOFF PLOTS CHARACTERIZED BY CLAYEY SOILS AND GROUNDS (RUSSIAN),
Ukrainskii Nauchno-Issledovatelskii Institut Lesnogo Khoziaistva, Kharkov (USSR).
V. M. Krynskiy.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii, No 7, p 108-115, 1967. 8 p, 3 fig, 4 tab, 3 ref.

Descriptors: *Rainfall-runoff relationships, *Runoff, *Discharge (Water), *Rainfall, *Precipitation (Atmospheric), *Moisture content, Geology, Clays, Soils, Water balance, Slopes, Topography, Winds, Porosity, Mathematical studies, Air temperature, Evaporation, Floods.
Identifiers: *USSR, Siberia, Birobidzhan.

By using runoff experimental plots in the Far East region (Siberia), rainfall-runoff and moisture content of clayey grounds was investigated. Geographical, geological, and hydrological data recorded during 1958-1961 were analyzed utilizing a formula of water balance for a single flood. Surface runoff from a series of rainfalls takes place if the moisture content of a one-meter layer exceeds 400 mm. Runoff is characterized by its gradual increase, as a result of additional rainfalls and moisture content increase. The saturation limits of runoff plots are achieved when there is 480 mm of moisture, or 84% of total moisture-holding capacity. (Gabriel-USGS)
W70-02227

RETAINING SURFACE RUNOFF ON AGRICULTURAL LANDS (RUSSIAN),
Ukrainskii Nauchno-Issledovatelskii Institut Lesnogo Khoziaistva i Agrolesomelioratsii, Kharkov (USSR).
G. P. Surmach.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii, No 7, p 116-121, 1967. 6 p, 3 tab, 5 ref.

Descriptors: *Surface runoff, *Land use, *Agricultural watersheds, *Soil conservation, Erosion control, Snowmelt, Soil erosion, Forests, Agricultural engineering, Soils, Precipitation (Atmospheric), Cultivation, Canal construction, Water storage, Groundwater.
Identifiers: *USSR, Orel province, European USSR, Kuibyshev region.

The retention of surface runoff on agricultural lands was investigated on the basis of hydrological data recorded at the experimental runoff plots of the Orel and Kuibyshev regions from 1950-1964. Runoff retention depends on several factors, such as type of soil, type of runoff water (snowmelt, standard rainfall), depth and methods of ploughing, etc. Proper methods of reforestation, canal construction, and better land cultivation should considerably decrease the process of erosion and surface runoff. (Gabriel-USGS)
W70-02228

WIND REPRODUCTION AND WINDFLOW MEASURING METHODS USING SPATIAL MODELS (RUSSIAN),
State Hydrological Inst. (USSR).
A. S. Sudol'skiy, and N. A. Davtyan.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii, No 7, p 158-165, 1967. 8 p, 5 fig, 1 tab, 3 ref.

Descriptors: *Model studies, *Winds, *Wind velocity, *Waves (Water), Air circulation, Altitude, Instrumentation, Lakes, Surface tension, Water level fluctuations, Indicators, Turbulence, Turbulent flow, Diffusion.
Identifiers: Wave models.

On the basis of a Lake Baikal model of 100 sq m in area, the principle parameters of wind waves were recorded using several fans and wave recording devices. A critical review is given of the methods and instruments utilized in this model study to help select the best methods for recording wind-formed waves. (Gabriel-USGS)
W70-02233

INVESTIGATION OF A LINEAR MODEL TO DESCRIBE HYDROLOGIC PHENOMENON OF DRAINAGE BASINS,
Texas A and M Univ., College Station. Water Resources Inst.
Fred A. Schmer.
Available from the Clearinghouse as PB-188 289, $3.00 in paper copy, $0.65 in microfiche. Research Project Technical Completion Report, Tech Report No 19, Dec 1969. 107 p, 8 tab, 27 fig, 58 ref, 2 append. OWRR Project A-008-TEX.

Descriptors: *Rainfall-runoff relationships, Hydrograph analysis, Surface runoff, Mathematical models, Hydrology, Watersheds, Unit hydrograph.

This investigation is concerned with the applicability of the linear convolution relationship for approximating the rainfall-runoff phenomenon for small drainage basins. A solution for the transfer function of the convolution relationship is obtained by employing discrete mathematics similar to the Wiener-Hopf equation. The solution is obtained, based on the restraints of the physical system by linear programming. In this investigation, the hydrologic system is analyzed as a truly linear system. Recorded rainfall intensity is the input of the system, and recorded runoff output. A major concern of the study involves the effects of antecedent moisture conditions on the transfer function. Two basins are used to test the model -- an urban basin located within the city limits of Bryan, Texas and a rural basin approximately three miles east of Bryan, Texas. Results are presented which substantiate the use of the proposed linear model as an approximation to the hydrologic system. Generalized transfer functions are developed for each basin and tested with independent events. Antecedent moisture conditions are shown to have a definite predictable effect on the transfer function, and rainfall events are classified with an antecedent moisture condition criteria in order to select the proper transfer function for the event.
W70-02238

MISCONCEPTIONS IN HYDROLOGY AND THEIR CONSEQUENCES,
Colorado State Univ., Fort Collins.
Vujica Yevjevich.
Water Resources Res, Vol 4, No 2, p 225-232, Apr 1968. 8 p.

Descriptors: *Hydrogeology, *Water resources, *Water resources development, *Water supply, Precipitation (Atmospheric), Probable maximum precipitation, Forecasting, Hydrologic aspects, Climatic data, Weather modification, Evaporation, Evaporation control, Stochastic processes, Permeability, Channel morphology, Hydraulics, Hydraulic engineering, Hydrology.
Identifiers: *Misconceptions in Hydrology, Deterministic concepts, Hidden periodicities, Evaporation supression.

Several misconceptions that have been introduced into hydrology have had adverse consequences on the science and on water-resources development. Persistent use of the concept of maximum precipitation and maximum probable precipitation, for which there is no physical proof, has discouraged research into the structure and probability of extreme events, and may have led to an unwarranted security concerning flood-control works. Attempts at long-range forecasts of water supply based entirely on meteorological processes have misdirected research and raised false expectations. A misconception that hydrologic processes are composed of a limited number of hidden periodicities has retarded the use of modern stochastic analyses of time series. Cloud-seeding to increase numbers of raindrops rather than their coalescence may have had a negative effect on precipitation in arid regions. Considering groundwater, instead of the aquifer, as a resource has stressed the technology of withdrawal at the expense of study of methods of recharge and has led

to much unplanned overdraft of groundwater. Use of descriptive instead of numerical variables has delayed the application of modern methods to planning the exploration of the groundwater environment. As a result of the neglect of the stochastic properties of porous mediums, fluid mechanics theory has not departed far from the original works of Darcy. (Carstea-USGS)
W70-02313

DESIGN STORM DETERMINATION IN SOUTH AFRICA,
University of the Witwatersrand Univ., Johannesburg (South Africa). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02B.
W70-02324

HYDROLOGICAL REGIONS OF NEW ZEALAND,
Ministry of Work, Wellington, (New Zealand). Water and Soil Div.
C. Toebes, and B. R. Palmer.
New Zeal Ministry of Works Misc Hydrol Publication No 4, 1969. 45 p, 24 ref, 1 append.

Descriptors: *Hydrologic data, *Rainfall-runoff relationships, *Surface-groundwater relationships, *Climates, *Classification, Mapping, Geomorphology, Geology, Soil classifications, Vegetation effects, Land use, Watersheds (Basins), International Hydrological Decade.
Identifiers: *New Zealand, *Hydrologic classification.

A detailed hydrological classification divides New Zealand into 90 regions on the basis of annual average precipitation, aquifer permeability, topography, and culture. Each region is described in detail and shown on an index map. (Knapp-USGS)
W70-02325

ANALYSIS OF CYCLIC FLUCTUATIONS OF ANNUAL RIVER DISCHARGES (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
A. V. Rozhdestvensky.
Gosudarstvennyi Gidrologicheskii Institut, Leningrad, Sbornik Rabot po Gidrologii No. 7, p 49-59, 1967. 6 tab, 12 ref.

Descriptors: *Discharge (Water), *Runoff, *Mathematical models, *Stochastic processes, *Mathematical studies, Water level fluctuations, Frequency analysis, Hydrologic data, Probability.
Identifiers: *Irtysh River, Angara River, Shilka River, Amur River of Siberia, Neva River, Volga River, Irtysh Unzha River.

Assuming random and stochastic (time-dependent) distribution of hydrologic data, the series of river discharge data of gaging stations in European Russian (Volga, Neva, and Unzha Rivers) and Siberia (Angara, Amur, and Irtysh Rivers) were statistically analyzed using the standard statistical methods and the Poisson law of distribution. The discharge fluctuations of the rivers studied exhibit stochastic or time dependent properties. It is of interest to note that the investigations by Alekhin (1963) on the correlation functions of annual discharges of 11 rivers show the presence of quasi-periodic functions with periods of 7-8, 14-16, and 20 years. (Gabriel-USGS)
W70-02417

GEOCHEMICAL DIFFERENTIATION OF PRODUCTS OF WEATHERING AND SOIL FORMATION ON THE RUSSIAN GREAT PLAIN,
Moscow State Univ. (USSR).
V. A. Kovda, E. M. Samoilova, V. D. Vasilevskaya, and I. V. Yakushevskaya.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 4, p 293-301, 1968. 2 fig.

Descriptors: *Soil formation, *Geochemistry, *Weathering, *Alkaline soils, *Semiarid climates, Soil groups, Glacial soils, Glaciers, History, Alkaline water, Groundwater, Carbonates, Calcium carbonate, Gypsum, Soil chemical properties.
Identifiers: *Plains, *USSR, North America.

The authors discuss the soil formation history of the Russian Great Plain. The plain is hydro-accumulative, formed during and after the glacial period. Changes in soils that occur in the southerly direction are due to occurrence of geochemical streams of surface and groundwater. The Great Plain was raised following glacial melting and the hydromorphic soils were subjected to neo-eluvial development processes. As the area became more arid, the soil regime was replaced by xerophytic processes and leaching of soils. The steppe and semi-deserts to the south became areas of accumulation of calcium carbonate, sodium carbonate and sodium bicarbonate in the soils and groundwater. Relict alkaline soils as well as current alkalinization are found on the Dnieper-Donetz and Oka-Donetz lowlands. Increased evaporation in the south caused gypsum to concentrate and come out of solution. The authors believe that similar soil phenomena occur in old alluvial plains with similar histories, for example, the plains of North America. (Crouse-Arizona)
W70-02428

THE REDISTRIBUTION OF THE MORE SOLUBLE CHEMICAL ELEMENTS ASSOCIATED WITH SOILS AS INDICATED BY ANALYSIS OF RAIN-WATER, SOILS AND PLANTS,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
J. T. Hutton.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 4, p 313-322, 1968. 6 tab, 11 ref.

Descriptors: *Soil-water-plant relationships, *Soil profiles, *Soil chemical properties, *Rain water, *Elements (Chemical), Arid climates, Soil water movement, Evaporation, Plants, Salts, Carbonates, Calcium, Magnesium compounds, Fluorine, Chemical analysis.
Identifiers: *Australia, Barium, Strontium.

Chemical analysis of rain water, soils, and plants were conducted in Victoria and South Australia to evaluate the cycle of soluble elements in soils. Near the ocean the composition of rain water is strongly influenced by ocean spray. In inland areas that are arid or that experience long periods of drought, dust from dried soil surfaces and plant particles is the main source of material in rain water. In areas of aridity or extensive drought, rapid evaporation causes soluble salts to collect on or near the soil surface. These chemicals are readily taken up by the vegetative cover. Less soluble salts such as the carbonates tend to accumulate deeper in the profile, barium near the bottom, and magnesium, calcium and strontium half way down. There was a marked horizon of fluorine in mid-profile. Distribution of the more soluble elements in a soil profile is thus controlled by rainfall and climatic factors such as evaporative potential. Where rainfall is insufficient to remove the soluble elements, definite distribution patterns can be found in the soil profile. (Crouse-Arizona)
W70-02431

2B. Precipitation

THE USE OF DOPPLER RADAR EQUIPMENT TO DETERMINE THE VERTICAL AIR VELOCITY IN RAIN,
For primary bibliographic entry see Field 07B.
W70-02056

A STATISTICAL STUDY OF THE DEPTH OF PRECIPITABLE WATER IN WESTERN TEXAS AND EASTERN NEW MEXICO,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 03B.
W70-02096

EFFECT OF HOUSING SHAPE ON THE CATCH OF RECORDING GAGES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 07B.
W70-02102

PUBLIC POLICY ISSUES IN WEATHER MODIFICATION,
California Univ., Santa Barbara.
For primary bibliographic entry see Field 06B.
W70-02129

EFFECT OF RAINFALL ON THE VELOCITY DISTRIBUTION AND TRACTIVE FORCE IN A TRIANGULAR OPEN CHANNEL,
Mississippi State Univ., State College; and Auburn Univ., Ala.
For primary bibliographic entry see Field 08B.
W70-02174

STOCHASTIC PROCESS OF PRECIPITATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
P. Todorovic, and V. Yevjevich.
Colo State Univ Hydrol Pap No 35, Sept 1969. 61 p, 41 fig, 9 tab, 12 ref, 3 append. Grant No GK-1661 and GK-11444. (Nat Sci Found).

Descriptors: *Stochastic processes, *Precipitation (Atmospheric), *Streamflow forecasting, *Precipitation intensity, Probability, Statistical models, Mathematical models, Storms, Time series analysis, Water yield, Hydrographs.
Identifiers: Stochastic hydrology.

The continuous process of precipitation intensities is investigated through the study of probability distributions of six descriptors: number of storms in an interval of time; number of storms producing a given amount of precipitation; lapse time between a reference time and the end of a storm; the total precipitation of n storms; the precipitation of nth storm; and the total precipitation in a time interval. The parameters of the number of storms per time unit, and of the inverse of the average yield per storm, are derived as periodic functions of time inside the year. The comparison of derived theoretical probability distributions and the observed frequency distributions for the four examples used in the study is good, considering the sampling errors. (Knapp-USGS)
W70-02298

DESIGN STORM DETERMINATION IN SOUTH AFRICA,
University of the Witwatersrand Univ., Johannesburg (South Africa). Dept. of Civil Engineering.
J. F. A. Wiederhold.
Witwatersrand Univ, Dep Civil Eng Hydrol Res Unit Rep No 1/69, 1969. 193 p, 56 fig, 37 tab, 36 ref, 6 append.

Descriptors: *Precipitation (Atmospheric), *Synoptic analysis, *Duration curves, *Design storm, Meteorology, Climatology, Depth-area-duration analysis, Rainfall-runoff relationships, Runoff forecasting, Streamflow forecasting, Hydrographs, Distribution patterns, Design flow, Water management (Applied), Mathematical models, Computer programs.
Identifiers: *South Africa.

In South Africa an attempt has been made to analyze extremes of precipitation and to provide information in a form suitable for hydrometeorological determination of the full range of design flood discharges. A single diagram depicts for the whole country (subdivided into summer-, winter-, and year-round-rainfall) depth-duration-frequency relationships for point rainfall of duration ranging from 1/4 hour to 24 hours. Techniques are developed for the fitting of high-degree polynomial

functions by computer to representations of storm rainfall to facilitate depth-area analyses. From depth-area analyses of 170 well-distributed major large-area storms experienced since 1932 in South Africa the country is subdivided into 29 meteorologically homogeneous subregions. Within each subregion available storm data are subjected to extreme value analysis to yield depth-area-duration-frequency relationships, and regional diagrams are presented. Estimates of precipitable moisture content of the atmosphere during each recorded storm provide an approach to probable maximum precipitation in the form of an upper envelope curve. The composite diagram for each subregion shows the isohyetal map of the most severe storm recorded (as a guide to shape and orientation of design storm), the depth-area-duration-frequency relationship and the PMP-area-duration graph. Details are given of the development of the surface-fitting procedures and of computer programs. (Knapp-USGS)
W70-02324

2C. Snow, Ice, and Frost

GLACIOLOGICAL RESEARCH IN NORWAY, 1968 (NORWEGIAN),
Norwegian Water Resources and Electricity Board, Oslo. Glaciology Section.
Gunnar Ostrem, Olav Liestol, S. R. Ekman, Christian Nielsen, and Svein Tornas.
Norges Vassdrags-Og Elektrisitetsvesen, Oslo, Rapp No 5/69, Mar 1969. 149 p, 85 fig, 5 charts, 2 map, 16 ref.

Descriptors: *Glaciers, *Hydrologic budget, *Regimen, Glaciation, Ablation, Melting, Movement, Precipitation (Atmospheric), Water sources, Sediment load, Streamflow.
Identifiers: *Norway.

The glaciohydrological measurements made in Norway in 1968 are tabulated and analyzed. A total of 10 glaciers in southern Norway and 3 in northern Norway were measured. On 5 glaciers meteorological observations were made during the main part of the summer season. Mass balance measurement error is estimated to be 4-8%, or about 20 cm of water equivalent. In 1968 snow accumulation was as much as 140% of normal; snow depths of 6-9 m were measured. In southern Norway the summer was 0.5C higher than normal, while in the north summer was almost 2C lower than normal. Mass balances were highly variable in the south, but all the northern glaciers showed surpluses. Triangulation nets are used to measure movement of all the glaciers studied. Movement data are tabulated and shown by maps. Sediment transport was measured in 4 glacial streams and a lake. (Knapp-USGS)
W70-02084

SALINE CONVERSION AND ICE STRUCTURES FROM ARTIFICIALLY GROWN SEA ICE,
Alaska Univ., College. Arctic Environmental Engineering Lab.; and Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 03A.
W70-02113

SNOW COVER DISTRIBUTION AS MAPPED FROM SATELLITE PHOTOGRAPHY,
Allied Research Associates, Inc., Concord, Mass.
For primary bibliographic entry see Field 07B.
W70-02314

SOME FEATURES OF ANTARCTIC SOILS AND THEIR RELATION TO OTHER DESERT SOILS,
Department of Scientific and Industrial Research, Wellington (New Zealand). Soils Bureau.
G. G. C. Claridge, and I. B. Campbell.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 4, p 541-549, 1968. 17 ref.

Descriptors: *Deserts, *Antarctic, *Cold regions, *Soil formation, *Soil investigations, Soil classifications, Semiarid climates, Climatic zones, Arid lands, Coasts.

Antarctica is characterized by cold and extreme aridity. Approximately two percent of this continent is free from permanent ice and snow cover--much of it in the New Zealand portion of the continent. Soil forming factors have begun to work on this area. The authors report a morphological study of three Antarctic soils. They are compared with soils of similar areas in Chile, the United States and Australia. The conclusion is that Antarctic soils bear a strong resemblance to desert and semiarid soils of other parts of the world with similar soil forming processes. Antarctic soils are described as typical of soils of cold deserts. (Crouse-Arizona)
W70-02437

2D. Evaporation and Transpiration

WATER USE BY SALTCEDAR WITH MANY FACTORS,
Geological Survey, Lubbock, Tex.
For primary bibliographic entry see Field 03B.
W70-02134

POTENTIAL EVAPOTRANSPIRATION AS INFLUENCED BY WIND,
Kansas State Univ., Manhattan.
E. L. Skidmore, H. S. Jacobs, and W. L. Powers.
Agron J, Vol 61, No 4, p 543-546, July-Aug 1969. 4 p, 6 fig, 1 tab, 19 ref.

Descriptors: Evaporation, *Evapotranspiration, *Winds, Wind velocity, Wind speed, Agronomy, Crops, Water requirements, Great Plains, Effects, Agriculture, Energy balance, Hydrology, Bibliographies, Soil science.
Identifiers: *Potential evapotranspiration, Hydrologic models, Effect, Net radiometer, Van Bavel method.

The contribution of wind to calculated potential evapotranspiration was investigated with applications for the climate of the Great Plains. A revised combination model proposed by van Bavel for computing instantaneous potential evapotranspiration was used. The model contains 2 terms that are expressions for the portions of potential evapotranspiration primarily caused by net radiation and wind. With ambient water vapor pressure 20 mb, temperature 30 deg C, wind 2, 4, and 6 m/sec at 2 m with a roughness length of 1 cm, the contribution of wind-dominant term to evaporation from a wet surface is 0.15, 0.30, and 0.45 mm/hr, respectively. At 10-mb vapor pressure and the same temperature, the corresponding evaporation rates are 0.22, 0.43, and 0.65 mm/hr. On representative and consecutive nonwindy and windy days at Manhattan, Kans (average daily windspeeds at 45 cm were 0.88 and 2.26 m/sec), the wind-dominant term contributed 33 and 113%, respectively, as much as the radiation-dominant term to the total calculated potential evapotranspiration. For these 2 days, the ratio of potential evapotranspiration to net radiation was 0.98 and 1.60. (USBR)
W70-02143

NOCTURNAL RADIATION LOSS ESTIMATES FOR A FOREST CANOPY,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
James D. Bergen.
USDA Forest Serv Res Note RM-155, 1969. 4 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Thermal radiation, *Nocturnal, Heat transfer, Mountain forests, Heat balance, Forestry, Topography, Temperature, Air temperature, Frost protection, Forests, Meteorology, Colorado.
Identifiers: *Radiation, *Thermal radiation.

Average nocturnal net radiation over a conifer canopy measured with a suspended radiometer was compared with that estimated from the black body emission at the average air temperature below the radiometer, and the sky radiation measured at some distance away. Values agreed within 20 percent for 5 nights; measured radiation averaged 9 percent higher than the estimate. No systematic variation was found with windspeed or humidity.
W70-02200

POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA BY THORNTHWAITE'S CLASSIFICATION,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
J. H. Patric, and Peter E. Black.
USDA Forest Serv Res Pap PNW-71, 1968. 28 p.

Descriptors: *Water balance, *Climatic data, *Evapotranspiration, *Rainfall-runoff relationships, *Climatic zones, Air temperature, Precipitation (Atmospheric), Moisture availability, Artic Ocean, Pacific Ocean, Consumptive use, Arid climates, Cold regions, Coniferous forests, Elevation, Humid climates, Tundra, *Alaska.
Identifiers: *Thornthwaite, Forest distribution.

Estimates and measurements of potential evapotranspiration (PET) by Thornthwaite's methods showed good agreement with estimates and measurements by other methods. Natural vegetation is closely related to climate. Vegetation distribution in the interior seems governed more by temperature than by moisture availability. The available data heavily bias classifications of climate to sea-level and valley-bottom conditions.
W70-02202

EMPIRICAL FORMULA STRUCTURE FOR CALCULATION OF WATER SURFACE EVAPORATION (RUSSIAN),
State Hydrological Inst. (USSR).
T. M. Gel'bukh.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii, No 7, p 151-157, 1967. 7 p, 3 fig, 2 tab, 9 ref.

Descriptors: *Analytical techniques, *Mathematical studies, *Evaporation, *Water loss, *Reservoir evaporation, Hydrologic properties, Meteorological data, Water temperature, Humidity, Pressure, Wind velocity, Altitude, Heat flow, Air circulation, Turbulence, Frequency analysis.
Identifiers: *USSR, Evaporation basins, Kazakh SSR.

Evaporation from water surfaces was investigated by using the data from artificial basins of 20 sq m in area located in western Kazakhstan, USSR. The data were analyzed on the basis of an empirical formula giving the evaporation intensity as a function of wind velocity, two constants, and vapor pressure, or by using a theoretical function of airflow stability and turbulence. The dynamic factors (wind velocity, surface roughness) and thermal stratification of contiguous air can deviate considerably from the mean values based on long-term observations. As a result of these deviations the 2 constants are of variable character and the evaporation formula containing these constants is not generally useful. The theoretical aerodynamic formula, however, can be widely used because its parameters can be relatively easily calculated by taking into consideration the hydrometeorologic elements of the water basins. (Gabriel-USGS)
W70-02232

WATER EVAPORATION SUPPRESSION,
Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 03B.
W70-02276

INFLUENCE OF SOLAR RADIATION REFLECTANCE ON WATER EVAPORATION,
Virginia Univ., Charlottesville.

For primary bibliographic entry see Field 03B.
W70-02277

HEAT AND MASS TRANSFER BETWEEN A WATER SURFACE AND THE ATMOSPHERE.
Tennessee Valley Authority, Norris. Div. of Water Control Planning.

TVA, Engineering Laboratory Report Revised, Aug 1968. 98 p, 44 ref.

Descriptors: *Heat transfer, *Mass transfer, Heat budget, Temperature, Evaporation, Heat balance, Solar radiation, Air temperature, Thermal conductivity, Latent heat, Enthalpy, Thermal radiation, Thermal pollution, Specific heat, Meteorology, Vapor pressure, Climatology.

Methods are reviewed and summarized for the computation of heat and mass transfer between a water surface and the atmosphere. The formulas presented are found in the technical literature and compared. The report deals with computation of all items of heat exchange, e.g., solar radiation, terrestrial long-wave radiation, evaporative and convective heat flux, etc. The summarized heat transfer terms can be used for the prediction of heat transfer in cases where only basic meteorological information is available. (Novotny-Vanderbilt)
W70-02401

2E. Streamflow and Runoff

VARIATIONS IN LOW-WATER STREAMBED ELEVATIONS AT SELECTED STREAM-GAGING STATIONS IN NORTHWESTERN CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W70-02045

EQUIVALENT DISTRIBUTIONS WITH APPLICATION TO RAINFALL AS AN UPPER BOUND TO FLOOD DISTRIBUTIONS,
Victoria State Rivers and Water Supply Commission (Australia).
For primary bibliographic entry see Field 02A.
W70-02046

FEASIBILITY STUDY OF THE USE OF THE ACOUSTIC VELOCITY METER FOR MEASUREMENT OF NET OUTFLOW FROM THE SACRAMENTO-SAN JOAQUIN DELTA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W70-02053

CHARACTERISTICS OF STREAMFLOW IN THE COLVILLE RIVER BASIN, STEVENS COUNTY, WASHINGTON,
Geological Survey, Tacoma, Wash.
Walter R. Scott.
Geol Surv Open-file Rep, 1969. 31 p, 13 fig, 13 tab, 10 ref.

Descriptors: *Water resources, *Washington, Surface waters, Groundwater, Streamflow, Precipitation (Atmospheric), Water levels, Water quality, Water wells, Reservoirs, Recharge, Data collections, Hydrologic data, Discharge (Water).
Identifiers: *Colville River Basin (Wash), Stevens County (Wash).

Ample water is available in the Colville river basin, Washington, to meet present requirements and those of many years to come. The average runoff from the basin during the 42-year period 1923-64 was about 216,000 acre-ft. The runoff has been as low as 51,000 acre-ft in 1930 and as great as 390,000 acre-ft in 1951. Most of the runoff originates in the higher parts of the basin, where precipitation is greatest and occurs mostly as winter snowfall. Because of the storage effect of accumulated snowfall the annual peak discharge usually occurs during the last 10 days of April rather than during the periods of peak precipitation. Peak discharges are not extremely large; the maximum of the Colville River at Kettle Falls is 3,230 cfs (3.21 cu ft per sec sq mi). Low flows persist throughout much of July, August, and September, with minimum discharges generally occurring in August. Groundwater for domestic use can be obtained in sufficient quantitites from wells tapping unconsolidated deposits nearly everywhere in the basin. Yields as great as 1,700 gpm can be obtained from some individual wells. Generally, the chemical quality of both the surface and groundwaters in the basin is good. (Knapp-USGS)
W70-02060

TEMPERATURE ANALYSIS OF A STREAM,
Geological Survey, Tacoma, Wash.
M. R. Collings.
Geol Surv Res 1969, Prof Pap 650-B, p B174-B179, 1969. 6 p, 6 fig, 2 tab, 6 ref.

Descriptors: *Water temperature, *Streamflow, *Time series analysis, Regression analysis, Meteorology climates, Surveys, Fishkill, Irrigation water, Cooling water, Industrial water, Dissolved oxygen.
Identifiers: Harmonic analysis.

Temperatures of a stream were fitted and defined by a harmonic analysis of the probable occurrence, at the 95% level, of maximum and minimum monthly temperatures and of median temperatures throughout the year. The 0.5-probability curve of maximum temperatures was found to have equivalent values of amplitude and phase angle to that of a curve fitting 9 years of monthly maximum temperatures. Investigations also were made to determine the acceptability of using spot-temperature observations, by harmonic analysis, to obtain mean monthly temperatures throughout the year. A comparison, by regression analysis, of the mean monthly temperatures, from the thermograph record, with the synthetically determined median monthly temperatures, from the spot measurements, showed a standard error of 1.6 deg C. Another comparison, between the average harmonic curve from 4 years of spot measurements and the median curve from the maximum and minimum monthly temperatures, showed a standard error of 0.9 deg C. (Knapp-USGS)
W70-02062

DECADE REPRESENTATIVE AND EXPERIMENTAL RESEARCH BASINS IN THE UNITED STATES.
For primary bibliographic entry see Field 07A.
W70-02064

APPLICATION OF POISSON DISTRIBUTION TO FLOOD SERIES,
Geological Survey, Washington, D.C.
P. H. Carrigan, Jr.
Geol Surv Res 1969, Prof Pap 650-B, p B162-B163, 1969. 2 p, 1 fig, 1 tab, 8 ref.

Descriptors: *Floods, *Statistical methods, *Time series analysis, *Probability, Discharge (Water), Streamflow, Flood forecasting, Base flow, Correlation analysis, Water storage.
Identifiers: *Poisson distribution.

The number of flood peaks per unit time (a year) above a selected base may be described by the Poisson distribution. The base magnitude must not be so low as to include carryover storage effects. A computer routine was developed to count the number of floods exceeding a selected discharge, to check the fit of the distribution, and to check for serial correlation. The Poisson distribution statistically describes the number of floods per unit time greater than a base, provided the base is of sufficient magnitude. Some rule of thumb for selection of the base, for example, an average of three peaks a year above base, may not ensure this sufficiency in base magnitude because the floods are affected by carryover storage. If a partial-duration series of flood discharges or flood stages is adequately described by the Poisson distribution, then there is no reason to reject the hypothesis that the number of floods per unit of time occur randomly in time. (Knapp-USGS)
W70-02078

REDUCTION OF FLUORESCENCE OF TWO TRACER DYES BY CONTACT WITH A FINE SEDIMENT,
Geological Survey, Albuquerque, N. Mex.; Geological Survey, Anchorage, Alaska; and Geological Survey, San Juan, Puerto Rico.
For primary bibliographic entry see Field 07B.
W70-02080

FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF VICTORVILLE), SAN BERNARDINO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W70-02085

FLOOD PLAIN INFORMATION, UPPER TRUCKEE RIVER, SOUTH LAKE TAHOE, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W70-02086

FLOOD PLAIN INFORMATION, SANTA YNEZ RIVER, SANTA BARBARA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W70-02087

FLOOD PLAIN INFORMATION, FLAT RIVER AREA, MISSOURI.
Corps of Engineers, St. Louis, Mo.
For primary bibliographic entry see Field 04A.
W70-02088

FLOOD PLAIN INFORMATION, CHENA RIVER, FAIRBANKS, ALASKA.
Corps of Engineers, Fairbanks, Alaska.
For primary bibliographic entry see Field 04A.
W70-02089

ON SOME CHARACTERISTICS OF STORAGE DAM ASSOCIATED WITH RESERVOIR OPERATIONS,
Ministry of Irrigation and Power, New Delhi (India).
For primary bibliographic entry see Field 04A.
W70-02111

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1964 -- PARTS 3 AND 4.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W70-02114

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1964 -- PARTS 1 AND 2.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W70-02115

DISCHARGE TO THE SEA FROM THE SHORES OF THE CONTERMINOUS UNITED STATES, ALASKA, AND PUERTO RICO,
Geological Survey, Washington, D.C.
Alfonso Wilson, and Kathleen T. Iseri.
eol Surv Hydrol Invest Atlas HA-282, 2 sheet, 1969. 4 fig, 3 map, 7 tab, 6 ref.

Descriptors: *Discharge (Water), *Streamflow, *United States, *Puerto Rico, Surveys, Data collections, Gaging stations, Water balance, Hydrologic budget, Runoff, Water yield.
Identifiers: Discharge summary (U.S. Streams).

A 2-sheet hydrologic atlas quantifies the surface-water part of the discharge to the sea from the shores of the conterminous United States, Alaska, and Puerto Rico. It is a contribution to the UNESCO-sponsored project of the International Hydrological Decade, World Water Balance. The atlas is a preliminary step toward determination of the national water balance and of the continental water balance of North America. Computation of the water balance requires evaluation of that part of the hydrologic cycle that occurs at the air-land and air-water interfaces. In its simplest terms, the water balance may be expressed as the algebraic sum of the moisture inflow, outflow, and change in storage. Through long periods of time the net change in storage is negligible, and the water-balance equation becomes simply: Inflow= Outflow. Submarine discharge from the United States is believed to be small compared with surface runoff. Records from the gaging station farthest downstream in each basin were used to determine the gaged runoff. Surface streams discharge 1,746,000 cfs of water from an aggregate drainage area of 2,655,000 sq mi. This is equivalent to a runoff depth of 8.93 in. per year. (Knapp-USGS)
W70-02120

FLOODS ON LEVISA FORK IN VICINITY OF PAINTSVILLE, KENTUCKY,
Geological Survey, Washington, D.C.
Curtis H. Hannum.
Geol Surv Hydrol Invest Atlas HA-328, 1 sheet, 1969. 6 fig, 2 photo, 1 map, 4 ref.

Descriptors: *Floods, *Kentucky, Appalachian Mountain Region, Water levels, Stage-discharge relations, Hydrographs, Profiles, Mapping, Non-structural alternatives, Planning, Zoning, Regulation, Data collections, Hydrologic data, Forecasting.
Identifiers: Levisa Fork, Paintsville (Ky).

Hydrologic data are presented to be used to evaluate the extent, depth, and frequency of floods that affect the economic development of flood plains of the Levisa Fork and its tributaries at Paintsville, Kentucky. The data provide a technical basis for solving existing floodplain problems and formulating regulations for land use and development to reduce future flood damage. The areas flooded by 5-, 25-, and 50-year floods are shown on a topographic map. Flood boundaries were constructed from flood profiles based on field and historic data. (Knapp-USGS)
W70-02121

FLOODS IN UPPER MILLSTONE RIVER BASIN IN VICINITY OF HIGHTSTOWN, NEW JERSEY,
Geological Survey, Washington, D.C.
George M. Farlekas.
Geol Surv Hydrol Invest Atlas HA-359, 1 sheet, 1969. 10 fig, 2 map, 2 tab.

Descriptors: *Floods, *New Jersey, Water levels, Stage-discharge relations, Hydrographs, Profiles, Mapping, Non-structural alternatives, Planning, Zoning, Regulation, Data collections, Hydrologic data, Forecasting.
Identifiers: Millstone River Basin, Hightstown (NJ).

Hydrologic data are presented to be used to evaluate the extent, depth, and frequency of floods that affect the economic development of flood plains of the Millstone River and its tributaries, Hightstown, New Jersey. The data provide a technical basis for solving existing floodplain problems and formulating regulations for land use and development to reduce future flood damages. The areas flooded by 5-, 25-, and 50-year floods are shown on a topographic map. Flood boundaries were constructed from flood profiles based on field and historic data. (Knapp-USGS)
W70-02122

FLOODS ON SUSQUEHANNA RIVER AT ONEONTA, NEW YORK,
Geological Survey, Washington, D.C.
Stephen Hladio.
Geol Surv Hydrol Invest Atlas HA-350, 1 sheet, 1969. 3 fig, 1 map, 1 tab, 6 ref.

Descriptors: *Floods, *New York, Appalachian Mountain Region, Water levels, Stage-discharge relations, Hydrographs, Profiles, Mapping, Non-structural alternatives, Planning, Zoning, Regulation, Data collections, Hydrologic data, Forecasting.
Identifiers: Susquehanna River, Oneonta (NY).

Hydrologic data are presented to be used to evaluate the extent, depth, and frequency of floods that affect the economic development of flood plains of the Susquehanna River at Oneonta, New York. The data provide a technical basis for solving existing floodplain problems and formulating regulations for land use and development to reduce future flood damage. The areas flooded by 5-, 25-, and 50-year floods are shown on a topographic map. Flood boundaries were constructed from flood profiles based on field and historic data. (Knapp-USGS)
W70-02123

SOME RELATIONSHIPS BETWEEN FIXED AND MEAN DAILY MAXIMUM DISCHARGES OF RAINFALL AND FLOODS IN THE BASIN OF THE UPPER VOLGA RIVER (RUSSIAN),
Hydrometeorological Service of the USSR, Moscow.
For primary bibliographic entry see Field 02A.
W70-02221

DETERMINATION OF MAXIMUM DISCHARGES OF RAINFALL FLOODS IN THE EASTERN CARPATHIANS RIVERS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W70-02223

METHODS FOR THE CALCULATION OF FLUCTUATIONS COEFFICIENTS OF SURFACE SPRING RUNOFFS FOR THE CONDITIONS REPRESENTED BY FOREST-STEPPE AND STEPPE ZONES OF THE EUROPEAN USSR (RUSSIAN),
Voronezh State Univ. (SSSR).
For primary bibliographic entry see Field 02A.
W70-02224

A MAP OF ANNUAL RUNOFF OF RIVERS OF THE ALAI AND TURKESTAN RANGES (RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Geografii.
For primary bibliographic entry see Field 02A.
W70-02225

MINIMUM RUNOFF OF ANGARA RIVER TRIBUTARIES (RUSSIAN),
All-Union Research Inst. of Water Supply, Drainage, Hydro-Engineering Works and Engineering Hydrogeology, Moscow (USSR).
Z. I. Petersen, and L. N. Popov.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst., Sbornik Rabot po Gidrologii, No 7, p 97-107, 1967. 11 p, 6 fig, 3 tab, 4 ref.

Descriptors: *Runoff, *Discharge (Water), *River basins, Geology, Climates, Precipitation (Atmospheric), Snow, Permafrost, Water level fluctuations, Vegetation, Forests, Hydrograph analysis, Evaporation, Air temperature, Dolomite, Limestones, Mathematical studies, Gaging stations.
Identifiers: *USSR, Angara River, Siberia.

The monthly and daily discharges of over 100 rivers of the Angara basin were analyzed on the basis of hydrologic data recorded at 99 gaging stations for several years. Geological, geographical, and hydrological studies show that the basin of 468,000 sq km in area is characterized by precipitation varying from 600 to 800 mm in the mountains, 350 to 400 m in the highlands, and by the presence of permafrost phenomena and karstic conditions in limestone and dolomite surface rocks. The results of the study are expressed by several maps and tables giving the distribution of minimum monthly and annual discharges in the Angara basin. (Gabriel-USGS)
W70-02226

A DISTRIBUTED LINEAR REPRESENTATION OF SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
William O. Maddaus, and Peter S. Eagleson.
Available from the Clearinghouse as PB-188 508, $3.00 in paper copy, $0.65 in microfiche. Mass Inst Technol Hydrodynamics Lab Rep No 115, June 1969. 134 p, 22 fig, 2 tab, 25 ref, append. OWRR Project No C-1069.

Descriptors: *Routing, *Rainfall-runoff relationships, *Mathematical models, *Computer programs, Flood routing, Hydrograph analysis, Simulation analysis, Model studies, Reservoirs, Overland flow, Streamflow, Linear programming, Optimization, Numerical analysis, Discharge (Water), Computer models, Streamflow forecasting.
Identifiers: *Kinematic wave analysis, Water shed models.

A distributed quasi-linear model of direct catchment runoff consists of cascades of linear reservoirs connected by linear channels. By fitting to the kinematic wave, the model parameters are expressed in terms of the physical characteristics of the catchment and the impulse response function is constrained to be input-dependent. Separate models of overland flow and streamflow are developed to facilitate consideration of spatially variable inputs. Investigation into the sensitivity of the catchment to distributed inputs illustrates the failure of the kinematic wave method to provide realistic hydrograph dispersion when applied to the flood-routing problem. (Knapp-USGS)
W70-02286

LOSS COEFFICIENT IN A CHANNEL BEND WITH NATURALLY DEFORMED BED,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 08B.
W70-02287

WATER-RESOURCES APPRAISAL OF CRATER LAKE NATIONAL PARK, OREGON,
Geological Survey, Portland, Oreg.
F. J. Frank, and A. B. Harris.
Geol Surv Open-file Rep, 1969. 26 p, 4 fig, 4 tab, 7 ref.

Descriptors: *Water resources, *National parks, *Oregon, Water resources development, Recreation, Water wells, Springs, Aquifers, Water levels, Permeability, Infiltration, Data collections, Hydrologic data, Hydrogeology.
Identifiers: Crater Lake National Park.

Crater Lake National Park is on the crest of the Cascade Range in southwestern Oregon. The area is underlain by andesitic and basaltic lavas, pumiceous volcanic flow breccias, tuffs, and airborne and flow pumice. The pumice is an excellent medium for the infiltration of much of the 67 inches of annual precipitation. In many areas of the park, the occurrence of perched groundwater at altitudes below 6,500 ft is shown by numerous springs. Most of the streams and springs flow throughout the year. The quality of the water is excellent. During 1962, test drilling in the northern part of the park failed to locate perched-water bodies capable of

supplying quantities of water adequate for proposed facilities. The regional water table is below an altitude of 4,960 ft and wells at high altitudes may have to be drilled to depths exceeding 1,000 ft. The possibility of obtaining productive wells in the area is speculative. Springs are the source of water supply for present facilities. The most favorable areas for the development of ground and surface water are in the western, southern, and southeastern parts of the park. These areas have a well-defined surface-drainage system and have many springs and streams at altitudes below 6,500 ft which discharge quantities of water adequate for additional park facilities. (Knapp-USGS)
W70-02293

GEOLOGY AND WATER RESOURCES OF BEADLE COUNTY, SOUTH DAKOTA: PART 2, WATER RESOURCES,
Geological Survey, Huron, S. Dak.
For primary bibliographic entry see Field 02F.
W70-02306

HYDROLOGY ANNUAL NO. 14 - 1966.
Ministry of Works, Wellington (New Zealand).

Copies of rep avail from The Government Printer, Private Bag, Wellington, New Zeal. Cost-$3.00 (post free). Soil Conserv and Rivers Contr Counc Annu Hydrol Rep, 1968. 247 p, 5 fig, 19 ref.

Descriptors: *Data collections, *Hydrologic data, *Bibliographies, Streamflow, Stream gages, Snow surveys, Snow cover, Low flow, Floods, Discharge (Water), Recession curves, Sediment load, Suspended load, Water quality, Channel morphology, Stage-discharge relations.
Identifiers: *New Zealand.

Hydrologic data collected at 25 stations in New Zealand in 1966 are tabulated. Collected data include a list of streamflow stations, precipitation gages, sediment gages, water quality stations, snow courses, groundwater observation sites, representative and experimental basins, streamflow tables, snow survey data, recession curves, suspended sediment rating curves, water quality data, flood data, and channel morphology and efficiency surveys. An annotated bibliography of hydrological papers about New Zealand and by New Zealand authors is included. Addresses of all local hydrological and meteorological authorities and agencies collecting data are also included. (Knapp, USGS)
W70-02307

FLOOD PLAIN INFORMATION, KUSKOKWIM RIVER, BETHEL, ALASKA.
Corps of Engineers, Anchorage, Alaska.
For primary bibliographic entry see Field 04A.
W70-02312

BASIC HYDROLOGIC DATA, FOR A PART OF THE BIG SIOUX DRAINAGE BASIN, EASTERN SOUTH DAKOTA,
Geological Survey, Huron, S. Dak.
For primary bibliographic entry see Field 02F.
W70-02317

HYDROLOGIC CONDITIONS DURING 1967 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
Claiborne F. Galliher, and John E. Hull.
Geol Surv Open-file Rep, Sept 1969. 46 p, 31 fig, 5 tab, 8 ref.

Descriptors: *Data collections, Hydrologic data, *Florida, Surface waters, Groundwater, Streamflow, Water levels, Rainfall, Runoff, Recharge, Water management (Applied), Drainage, Irrigation, Canals.
Identifiers: *Dade County (Fla).

A quantitative picture of the general hydrologic conditions which prevailed in Dade County, Florida for the 1967 water year (October 1, 1966 to September 30, 1967) is summarized by use of tables, graphs, and maps. The location of groundwater stations and location of rainfall and surface-water stations are shown by a map. The water level, discharge and rainfall data were obtained from an extensive network of groundwater observation wells, stream-gaging stations, and rainfall stations. The records from long-term installations (1940 to present) are of special value because they allow analysis of the hydrologic effects of some water-control practices. (Knapp-USGS)
W70-02318

HYDROLOGICAL REGIONS OF NEW ZEALAND,
Ministry of Work, Wellington, (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02A.
W70-02325

STATISTICAL DISCRIMINATION OF CHANGE IN DAILY RUNOFF,
Colorado State Univ., Fort Collins. Dept of Civil Engineering.
Andre J. Dumas, and Hubert J. Morel-Seytoux.
Colo State Univ Hydrol Pap No 34, Aug 1969. 29 p, 6 fig, 9 tab, 22 ref, 2 append. Contract No BR14-06-D-6597 (Bur of Reclam).

Descriptors: *Runoff forecasting, *Statistical methods, *Cloud seeding, Water resources development, Optimization, Sampling, Streamflow forecasting, Stochastic processes, Data processing, Routing.
Identifiers: Runoff change detection.

A technique was developed for rapid detection of suspected hydrologic change in high mountain watersheds. The method uses a sequence of independent daily flows. This procedure is superior to previous ones based on seasonal or yearly flows. The use of daily, instead of seasonal flow, data in a Student t-test reduces the number of necessary years of data for detection by an average of five in 14 out of the 20 cases studied, or by an average of three for the 20 cases. All of the cases come from the Upper Colorado River Basin. The study is particularly relevant to the planned cloud seeding operations of the Bureau of Reclamation in high elevation areas of the Colorado Rocky Moutains. The statistical procedure of detection relies on the Target Control concept and the application of a conditional Student t-test, a test of the difference between the adjusted means obtained by the regression lines between Target and Control for the seeded and non-seeded periods. (Knapp-USGS)
W70-02330

ON THE DIFFUSION OF HEATED JETS,
Royal Netherlands Meteorological Inst., De Bilt.
F. H. Schmidt.
Tellus, Quarterly Journal of Geophysics, Volume 9, No 3, p 378-383, Aug 1957. 2 fig, 8 ref.

Descriptors: *Jets, Temperature, Velocity, Distribution patterns, Flow profiles.

The propagation was studied of a heated jet in a stagnant environment in order to get a general solution without introducing any special assumptions about the velocity and temperature distributions in the jet. It was shown that Schmidt's and Tollmien's solutions are contained in the general one developed. A new cross-sectional velocity distribution was proposed, which seemed to be preferable above the generally accepted Gaussian distribution. In the development of the solution, no account has been taken of the fact that the similarity of velocity and temperature profiles only comes into being at distances of about ten times the diameter of the aperture from the orifice. It has been found that the flow in a free jet is a very complicated hydrodynamic phenomenon. (Guerrero-Vanderbilt)
W70-02402

HORIZONTAL SURFACE DISCHARGE OF WARM WATER JETS,
California Univ., Berkeley.
Nobuyuki Tamai, Robert L. Wiegel, and Gordon F. Tornberg.
Journal of the Power Division, Proceedings of ASCE, Vol 95, No PO2, p 253-276, Oct 1969. 12 fig, 1 tab, 23 ref.

Descriptors: *Jets, *Mixing, *Turbulent flow, *Cooling towers, Thermal powerplants, Thermal pollution, Heated water.

An attempt was made to: (1) present data from a number of sources on the cooling water capacities of thermal powerplants, together with the flow characteristics; (2) compare the results of a number of studies of the mixing of buoyant flows discharged horizontally at the surface of a body of water; and (3) present the results of new studies of such flows. Experiments were performed in a tank 25 feet long by 3 1/2 feet wide by 2 feet deep. A hot water heater was installed to provide the necessary hot water. The flow of the jet was measured by an orifice meter in the pipeline and controlled by a valve. Measurements were made using a commercially available multipoint strip chart recorder. The time between two successive measurements was 1.67 sec. Large thermal-electric powerplants use an average of 1.5 cfs per Mw cooling water, with a temperature rise of about 10 to 20 deg F and flow velocities with a mean of about 7 fps; the resulting densimetric Froude numbers range from 2.5 to 12.5. A review of laboratory studies and prototype measurements indicate that this is in the range of transition from jet mixing to surface spreading regimes, with the possibility of a third regime existing for the lowest densimetric Froude numbers. It appears that the mixing by turbulence in the receiving water of the prototype is of equal importance to the mixing by the turbulence within the prototype jet. (Guerrero-Vanderbilt)
W70-02412

MODELING OF ABRUPTLY VARYING STREAM CURRENTS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
A. N. Lyapin.
Gosudarstvennyi Gidrologicheskii Institut, Leningrad, Sbornik Rabot po Gidrologii No 7, p 141-145, 1967. 1 fig, 5 ref.

Descriptors: *Mathematical models, *Mathematical studies, *Streamflow, River flow, Currents (Water), Bottom sediments, Water circulation, Simulation analysis, Pressure, Energy, Turbulent flow, Friction, Froude number, Velocity, Energy dissipation.
Identifiers: *USSR, Streamflow models.

On the basis of modified standard differential equations of motion, the Froude number, and two nondimensional mathematical criteria, a method was developed for analytical modeling of variable streamflows. The use of analytic modeling gives results comparable with those obtained from experimental observations, if the tangential accelerations of negative character are assumed to be constant and equal to their maximum values. Moreover, for practical utilization of this analytical modeling it is necessary to have the value of a coefficient K which reflects the value of pressure gradient. (Gabriel-USGS)
W70-02415

ANALYSIS OF CYCLIC FLUCTUATIONS OF ANNUAL RIVER DISCHARGES (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W70-02417

2F. Groundwater

GROUNDWATER LEVELS IN THE UNITED STATES, 1962s66, NORTH-CENTRAL STATES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W70-02044

NOTES ON THE GEOLOGY AND PALEOHYDROLOGY OF THE BOULDER CITY PLUTON, SOUTHERN NEVADA,
Geological Survey, Denver, Colo.
R. Ernest Anderson.
Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402 Price $2.75. Geol Surv Res 1969, Prof Pap 650-B, p B35-B40, 1969. 6 p, 5 fig, 4 ref.

Descriptors: *Paleohydrology, *Nevada, Groundwater movement, Water chemistry, Igneous rocks, Iron oxides.
Identifiers: Boulder City Pluton (Nev).

The Boulder City pluton, a composite granitoid Tertiary intrusive mass exposed for more than 10 sq mi in the extreme northern Eldorado Mountains, Nevada-Arizona, is bounded mostly by faults. It locally intrudes Patsy Mine Volcanics, and is capped by Mount Davis Volcanics. On the basis of stratigraphic and isotopic data, the pluton has an age ranging from Eocene to Miocene. The pluton and adjacent rocks are crossed at an altitude of about 2,400 ft by a horizontal red-brown cliff-forming zone that was probably colored by deposition of ferric oxide from groundwater solutions as an ancient water table fluctuated over an interval of about 100 ft. Subsequent downcutting by the Colorado River has exposed the pluton to a depth of about 1,800 ft below this zone, and thus reveals that the pluton is probably not a laccolith or sill-like mass as has been previously suggested. (Knapp-USGS)
W70-02073

DEVELOPMENT OF GROUNDWATER SUPPLIES ON THE PAJARITO PLATEAU, LOS ALAMOS COUNTY, NEW MEXICO,
Geological Survey, Santa Fe, N. Mex.; and Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 03B.
W70-02076

OCCURRENCE AND MOVEMENT OF GROUNDWATER IN THE BRUNSWICK SHALE AT A SITE NEAR TRENTON, NEW JERSEY,
Geological Survey, Trenton, N.J.; and New Jersey State Dept. of Conservation and Economic Development. Water Policy and Supply Div.
For primary bibliographic entry see Field 03B.
W70-02077

CORRELATION OF CARBONATE ROCK UNITS IN NORTHWEST OHIO BY NATURAL GAMMA LOGGING,
Geological Survey, Columbus, Ohio.
For primary bibliographic entry see Field 07B.
W70-02079

EFFECTS OF RESERVOIR FILLING ON A BURIED AQUIFER OF GLACIAL ORIGIN, CAMPBELL COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, S. Dak.
For primary bibliographic entry see Field 03B.
W70-02081

GROUNDWATER RESOURCES OF KIMBLE COUNTY, TEXAS,
Geological Survey, Austin, Tex.
W. H. Alexander, Jr., and J. H. Patman.
Tex Water Develop Board Rep No 95, May 1969. 93 p, 14 fig, 5 tab, 48 ref.

Descriptors: *Water resources, *Groundwater, *Texas, Aquifers, Water wells, Water yield, Water levels, Water quality, Water supply, Water storage, Groundwater movement, Hydrologic data, Data collections, Hydrogeology.
Identifiers: Kimble County (Tex), Edwards Limestone.

The aquifer formed by the Edwards and associated limestones, which underlies all of the upland areas in Kimble County, Texas is the most extensive source of fresh groundwater in the county. In addition to the flow of springs, this aquifer supplied an estimated 420 acre-feet in 1964. The theoretical quantity available for future development from this aquifer in Kimble County is about 33,000 acre-feet per year. The alluvial deposits along the major streams, although relatively small in capacity to store water, supply more than half of the fresh water pumped from wells in Kimble County--about 1,200 acre-feet of the total 1,900 acre-feet in 1964. This aquifer supplies annually about 1,000 acre-feet to the city of Junction and most of the 210 acre-feet pumped for irrigation. The total quantity of water available for future development from all of the alluvial deposits is closely related to the minimum base flow of the Llano River. The minimum base flow was 10 mgd during the summer period (April through September) of 1955, which is several times the present use. The other aquifers in the county yield a total of about 30 acre-feet of fresh water per year. (Knapp-USGS)
W70-02091

VALUATION OF A GROUNDWATER SUPPLY FOR MANAGEMENT AND DEVELOPMENT,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 06B.
W70-02110

WATER BALANCE AND RUNOFF UNDER THE CONDITIONS OF SUBSURFACE KARSTIC ENVIRONMENT (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W70-02219

INVESTIGATIONS OF THE RELATIONSHIP BETWEEN SURFACE WATERS AND FISSURE-KARSTIC GROUNDWATERS OF THE AY RIVER BASIN (RUSSIAN),
Institut po Proektirovaniiu Predpriiatii Nikelevoi Promyshlennosti, Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W70-02220

FEASIBILITY STUDY OF ELECTRICAL GEOPHYSICAL METHODS IN THE DETERMINATION OF SUBSURFACE HYDROGEOLOGIC ENVIRONMENTS IN THE PIEDMONT AREA OF SOUTH CAROLINA,
Clemson Univ., S.C. Water Resources Research Inst.
For primary bibliographic entry see Field 07B.
W70-02241

ANALYSIS OF GROUNDWATER USE, REPLENISHMENT, AND AQUIFER CHARACTERISTICS IN BARTHOLOMEW COUNTY, INDIANA,
Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
L. G. Davis, A. K. Turner, and W. N. Melhorn.
PB-188 510. Purdue Univ Water Resources Res Center Tech Rep No 3, June 1969. 83 p, 33 fig, 5 tab, 46 ref, 2 append. OWRR Proj No A-006-IND.

Descriptors: *Water level fluctuations, *Indiana, *Statistical methods, *Analog models, Groundwater movement, Recharge, Discharge (Water), Water levels, Correlation analysis, Data collections, Water table.
Identifiers: Trend surface analysis, Bartholomew County (Ind).

A 50-sq mi section of unconfined aquifer in glacial outwash in Bartholomew County, Indiana was studied by trend surface techniques while the U.S. Geological Survey performed an analog model study. Detailed information on geologic conditions, recharge, discharge rates, and water levels measured for 13 consecutive months at 30 observation wells was used. Fourth-degree trend surfaces were the most complex that could be fitted to the data because of clustering of some wells. Computer-generated trend and residual maps were produced. Map comparisons utilized 'cross-correlation' procedures. The water-table geometry went through a cyclic change reflecting seasonal changes in recharge and discharge rates. Map comparison procedures suggest the groundwater regime reacts to such changes with a delay of less than one month. Graphical and statistical procedures are important in evaluating the significance of any trend surface. Under favorable conditions trend surfaces can help identify influent and effluent streams, and the influence of buried drainage patterns on the groundwater flow. The results of trend analysis closely agree with results obtained by analog models. (Knapp-USGS)
W70-02288

WELLS PROVIDE SEA WATER - NATURALLY FILTERED.
For primary bibliographic entry see Field 03A.
W70-02290

WATER-RESOURCES APPRAISAL OF CRATER LAKE NATIONAL PARK, OREGON,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 02E.
W70-02293

GROUNDWATER RESOURCES OF THE BURIED MAHOMET BEDROCK VALLEY,
Illinois State Water Survey, Urbana.
Adrian P. Visocky, and Richard J. Schicht.
Ill State Water Surv Rep Invest No 62, 1969. 52 p, 37 fig, 22 tab, 40 ref.

Descriptors: *Aquifers, *Glacial drift, *Valleys, *Illinois, Water resources, Groundwater, Hydrogeology, Hydrologic data, Data collections, Water wells, Water yield, Permeability, Transmissivity, Water quality, Water resources development, Model studies, Analog models, Recharge.
Identifiers: *Mahomet buried valley (Ill).

The buried Mahomet Bedrock Valley and its major tributaries cover about 3700 square miles in east-central Illinois, and form a large underdeveloped groundwater resource. The largest source of groundwater consists of Kansan sands and gravels, called the deep aquifer; the Illinoian or middle aquifer is a secondary source. Pumpage was 40.2 mgd in 1965. Major pumping centers are at Champaign-Urbana, Rantoul, Lincoln, Taylorville and Hoopeston; the largest is Champaign-Urbana with pumpage of 13.5 mgd in 1965. Recharge in the Champaign-Urbana area was computed to be 115,000 gpd/sq mi for the Illinoian aquifer in 1947 and 107,000 gpd/sq mi for the Kansan aquifer during 1953-1965. Total groundwater runoff for the valley is estimated to be about 740/mgd during years of normal precipitation. Existing and/or future pumping centers might capture 445 mgd. An electric analog computer was constructed for the Champaign-Urbana area. Withdrawals with a selected pumping scheme would total 30.3 mgd from existing large capacity wells and 15 mgd from 5 future wells. This study provides data for planning and development of area groundwater resources. (Knapp-USGS)
W70-02305

GEOLOGY AND WATER RESOURCES OF BEADLE COUNTY, SOUTH DAKOTA: PART 2, WATER RESOURCES,
Geological Survey, Huron, S. Dak.
Lewis W. Howells, and Jerry C. Stephens.

Available, no charge, from South Dakota Geol Survey, Science Center, South Dakota University, Vermillion. S Dak Geol Surv Bull No 18, 1968. 65 p, 11 fig, 2 plate, 8 tab, 43 ref, 3 append.

Descriptors: *Water resources, *Groundwater, *Surface waters, *Surveys, *South Dakota, Streamflow, Water supply, Water wells, Water yield, Water quality, Hydrologic data, Data collections, Hydrogeology.
Identifiers: Beadle County (S Dak).

The surface-water resources of Beadle County, S. Dak. are relatively undeveloped. During 1963, except for about 1,800 acre-ft diverted for irrigation, 2,785 acre-ft diverted for municipal and industrial uses, and small diversions for stock supplies, most of the flow was unused. Average net runoff from the surface of the county is more than 25,000 acre-ft per year. Most of the 1.2 million acre-ft of precipitation in an average year is lost as evapotranspiration. More than 5 million acre-ft of water is stored in 3 aquifers in surficial deposits. About 3,200 acre-ft was pumped from about 700 wells in 1963 for irrigation, stock, domestic, and municipal supplies. Two artesian aquifers in bedrock strata are major sources of water for stock, domestic, and municipal use. The aquifer in the Niobrara Marl and Codell Sandstone Member of the Carlile Shale supplies soft water to about 140 wells in the east-central third of the country. The aquifer in the Dakota Formation supplies water to more than 1,060 wells (most of which flow) throughout the county. (Knapp-USGS)
W70-02306

HYDROLOGY ANNUAL NO. 14 - 1966.
Ministry of Works, Wellington (New Zealand).
For primary bibliographic entry see Field 02E.
W70-02307

GROUNDWATER RESOURCES AND HYDROGEOLOGY OF THE ANNAPOLIS-CORNWALLIS VALLEY, NOVA SCOTIA,
Nova Scotia Dept. of Mines, Halifax. Groundwater Section.
Peter C. Trescott.
Nova Scotia Dep Mines Mem 6, 1968. 159 p, 50 fig, 2 map, 21 tab, 80 ref, 6 append.

Descriptors: *Water resources, *Groundwater, *Aquifers, *Surveys, Data collections, Hydrologic data, Mapping, Water yield, Water quality, Water wells, Recharge, Gravels, Glacial drift, Water levels, Water table, Water supply.
Identifiers: *Canada, *Nova Scotia, Annapolis-Cornwallis Valley, Aquifer testing.

The largest resource of fresh water in the Annapolis-Cornwallis Valley, Nova Scotia is stored in the ground. Major aquifers are present in the Triassic bedrock and in the overlying surficial deposits. The most extensive aquifers are the Triassic Wolfville sandstones and conglomerates, which underlie the entire Valley. It is often possible to construct wells in these aquifers which will yield several hundred gpm. The most important local aquifers, however, are the glacial sand and gravel deposits which are found mostly in the eastern and central parts of the Valley. A well has been constructed in one of these aquifers which will yield over one thousand gpm. The surficial deposits and pertinent bedrock boundaries in the Valley have been mapped at a scale of 1 inch to 1 mile. A second map was made of the bedrock hydrostratigraphic units, the saturated thickness of sand and gravel, and the depth to the water table. Information on the hydraulic properties of the aquifers was obtained with pump tests. With the information available, a hydrologic budget was calculated. Of 42 inches of precipitation in this basin during a 'normal' year, about 53% is discharged as storm and snowmelt runoff, 17% as groundwater runoff, and 30% as evapotranspiration. (Knapp-USGS)
W70-02309

BASIC HYDROLOGIC DATA, FOR A PART OF THE BIG SIOUX DRAINAGE BASIN, EASTERN SOUTH DAKOTA,
Geological Survey, Huron, S. Dak.
Michael J. Ellis, and Donald G. Adolphson.
Available, no charge, from South Dakota Geol Survey, Science Center, South Dakota University, Vermillion. S Dak Geol Surv - S Dak Water Resources Comm Water Resources Rep No 5, 1969. 124 p, 6 fig, 12 ref, 1 append.

Descriptors: *Hydrologic data, *Data collections, Water wells, Water levels, Observation wells, Streamflow, Water quality, Surface waters, Groundwater.
Identifiers: Big Sioux River basin (S Dak).

Basic groundwater and surface data are compiled for the Big Sioux River Basin, eastern South Dakota. Tabulated data include logs of test holes and observation wells, water levels in observation wells, aquifer properties, streamflow records, and water chemical analyses. (Gabriel-USGS)
W70-02317

HYDROLOGIC CONDITIONS DURING 1967 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02E.
W70-02318

HYDROLOGICAL REGIONS OF NEW ZEALAND,
Ministry of Work, Wellington, (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02A.
W70-02325

GEOCHEMICAL INVESTIGATION OF THE GROUNDWATER SYSTEM IN THE LANSING, MICHIGAN, AREA,
Michigan State Univ., East Lansing. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W70-02328

2G. Water in Soils

AERIAL-PHOTO INTERPRETATION IN CLASSIFYING AND MAPPING SOILS.
Soil Conservation Service, Beltsville, Md.
For primary bibliographic entry see Field 07C.
W70-02066

SOIL-MOISTURE LOSSES IN THE UPPER THREE INCHES OF SOIL, CIBECUE RIDGE, ARIZONA,
Geological Survey, Tacoma, Wash.
M. R. Collings.
Geol Surv Res 1969, Prof Pap 650-B, p B194-B198, 1969. 5 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Soil moisture, *Rainfall-runoff relationships, *Water loss, *Evapotranspiration, *Antecedent precipitation, Drying, Hydrologic budget, Evaporation, Water yield, Infiltration, Sampling, Regression analysis.
Identifiers: *Antecedent moisture.

Samples of the upper 3 inches of soil were collected on two small study areas in east-central Arizona for 2 years during the period of summer rainfall to define a relation for predicting antecedent soil-moisture conditions. The data of available moisture versus time were found to fit an exponential regression. The regressions have 0.03-inch and 0.04-inch standard errors of estimate. Antecedent soil moisture, in the upper 3 inches, may be predicted with 0.065-inch and 0.109-inch standard errors of estimate. (Knapp-USGS)
W70-02083

SEEPAGE TESTS IN L-D1 BORROW CANAL AT LAKE OKEECHOBEE, FLORIDA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04A.
W70-02095

MEASUREMENT OF SOIL MOISTURE IN THE FIELD BY NEUTRON MODERATION,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 07B.
W70-02124

THE INFLUENCE OF TEXTURE ON THE MOISTURE CHARACTERISTICS OF SOILS: IV. A METHOD OF ESTIMATING THE AVAILABLE-WATER CAPACITIES OF PROFILES IN THE FIELD,
National Vegetable Research Station, Wellesbourne (England).
P. J. Salter, and J. B. Williams.
J Soil Sci, Vol 18, No 1, p 174-181, Mar 1967. 8 p, 2 fig, 1 tab, 11 ref.

Descriptors: *Soil moisture, *Moisture availability, *Soil texture, Soil horizons, Soil profiles, Water utilization, Particle size, Soil types, Water storage, Field capacity.
Identifiers: *Available soil water capacity, Textural classes.

The available-water capacity (AWC) of soil profiles in the field may be estimated by (a) measuring the thickness of each soil horizon; (b) assessing its texture; and (c) summing the products of the thickness of each horizon and the mean values of AWC for the relevant textural classes. This mean value of AWC was calculated from the average particle-size composition and from a relationship between particle size composition and AWC. Estimates of AWC using this method were compared with measured values for each of 39 soils. When a 21 textural-class system was used to describe the soils, the mean error (the error of the estimated AWC value relative to the measured value) was 10% and with a 12 class system the mean error was 17%. (Carstea-USGS)
W70-02125

INFLUENCE OF ADSORBED SODIUM AND GYPSUM CONTENT ON PERMEABILITY OF GLACIAL TILL SOILS,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. C. Van Schaik.
J Soil Sci, Vol 18, No 1, p 42-46, Mar 1967. 5 p, 2 fig, 1 tab, 8 ref.

Descriptors: *Permeability, *Sodium, *Gypsum, *Glacial soils, Soil water movement, Till, Montmorillonite, Clay minerals, Ion exchange, Particle size, Clays.
Identifiers: *Exchangeable sodium percentage, Adsorbed sodium.

The permeability of glacial till soils having mainly montmorillonite in the clay fraction was negligible when the exchangeable sodium percentage (ESP) exceeded 15 to 20. Relatively higher permeability values were obtained in soils containing gypsum, but water tramsmission through such soils was negligible above ESP of 30 to 35. The relative decrease in permeability with increase in exchangeable sodium depends not only on the ESP and electrolyte concentration in the soil solution but is affected by the types of clay minerals. (Carstea-USGS)
W70-02126

FACTORS AFFECTING INFILTRATION AND RECHARGE IN A LOESS COVERED BASIN,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 04B.
W70-02154

SOIL-MOISTURE LEVELS IN SOME REPRESENTATIVE SOILS NEAR JUNEAU, ALASKA,
Forest Service (USDA), Portland Oreg. Pacific Northwest Forest and Range Experiment Station.
J. H. Patric, and F. R. Stephens.
Soil Science, 106 (3): p 172-176, 1968.

Descriptors: *Evapotranspiration, *Moisture availability, *Moisture content, *Tension, Bulk density, Porosity, Sub-arctic, Forest soils, Glacial soils, Organic soils, Soil moisture, Moisture uptake, Rainfall, Consumptive use, *Alaska.
Identifiers: Sub-arctic soils, Sub-arctic vegetation, Penman.

Moisture content of forest soils near Juneau, Alaska, was measured with tensiometers during the 1966 growing season. Tension never exceeded 0.25 atmosphere except on a very shallow soil (0.60 atmosphere) and in a bed of annual flowering plants (0.73 atmosphere) subject to advective energy. Daily soil-moisture loss agreed closely with evaporative loss. Soil-moisture losses were almost identical on clearcut and nearby forested soil of the same type and suggest that forests in southeast Alaska rarely, if ever, experience damaging soil-moisture deficits.
W70-02201

EFFECTS OF MARGINAL QUALITY IRRIGATION WATER ON THE ACCUMULATION OF SALTS AND ALKALI IN SOUTH DAKOTA SOILS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 03C.
W70-02280

A METHOD OF RADIOACTIVE INDICATOR DILUTION FOR EVALUATION OF WATER CIRCULATION IN PEAT BOGS (RUSSIAN),
N. I. Il'in, and Ye S. Dzektser.
Gosudarstvennyi Gidrologicheskii Institut, Leningrad, Sbornik Rabot po Gidrologii No 7, p 166-169, 1967. 2 fig, 1 tab, 4 ref.

Descriptors: *Groundwater movement, *Water circulation, *Peat, *Bogs, *Tracers, Tracking techniques, Radiochemical analysis, Radioactivity techniques, Indicators, Boreholes, Soils, Water analysis, Discharge (Water), Sands, Pressure, Frequency analysis, Drainage patterns (Geologic), Statistics.
Identifiers: *USSR, Gorki region, Peat bogs.

On the basis of a formula giving groundwater discharge as a function of initial and successive concentrations of an indicator in a borehole and the borehole dimensions, water circulation in peat bogs in the Gorki region of European USSR was investigated. A method of radioactive indicator dilution, using a single borehole, can be used for reliable determination of the thickness of water-bearing peat layers and their water circulation. However, this method does not localize in depth the layers characterized by anomalous water circulation and therefore, can be used only as a tool of preliminary exploration. (Gabriel-USGS)
W70-02416

AEOLIAN MIGRATION OF WATER SOLUBLE MATTER AND ITS PROBABLE GEOCHEMICAL AND SOIL FORMATION SIGNIFICANCE,
Leningrad State Univ. (USSR).
A. F. Tsyganenko.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 4, p 333-341, 1968. 18 ref.

Descriptors: *Soil chemical properties, *Geochemistry, *Weathering, *Soil formation, *Migration, Salt balance, Salts, Rain water, Pollutants, Soil contamination, Ion exchange, Precipitation (Atmospheric).
Identifiers: *USSR, Aeolian migration.

Notice is taken of the recent availability of data indicating substantial amounts of atmospheric pollutants entering the soil. This paper reviews literature on this subject and discusses implications regarding geochemical and soil forming processes and the salt balance on the land. Only in mountain areas or areas of widely spread salt bearing rocks does ionic runoff in rivers exceed ion income from the atmosphere to river basins. Principle sources of salts are ancient accumulations in sedimentary deposits and continental reservoirs as well as the ocean. These sources are found more important than modern processes of rock decay. Aeolian migration of salts from arid zones as well as the ocean is contrary to some extent to the normal concept of movement of salts by river flow from land to ocean. Pedology should take into consideration the chemical content of rain water in soil formation and chemistry. The literature cited and the discussion are confined mainly to areas in the USSR. (Crouse-Arizona)
W70-02421

A CONSTANT HEAD TANK FOR RAINFALL SIMULATORS,
Arizona Agricultural Experiment Station, Tucson; and Arizona Univ., Tucson. Dept. of Watershed Management.
Malcolm J. Swolinski.
Progressive Agriculture in Arizona, Vol 21, No 3, p 8-9, May-June 1969. 2 p, 2 fig, 7 ref.

Descriptors: *Rainfall simulators, *Infiltrometers, *Infiltration, *Research equipment, *Semiarid climates, Arizona, Soil water, Simulated rainfall, Watershed management, Instrumentation.
Identifiers: *Head tanks.

Hydrologic performance of a watershed is dependent upon the ability of its soils to absorb and transmit water. In development of watershed management programs, it is important to know infiltration characteristics of soils. This information is frequently obtained through application of artificial rainfall to infiltrometer plots established on the soils being studied. Successful measurement requires application of simulated rain at a predetermined rate and with constant distribution over the plot. The author reports development and design details of an apparatus designed to meet these requirements. Instrumentation was developed and used for infiltration studies in semiarid forest lands of northeastern Arizona to assist in developing watershed management plans concerned with flood and erosion control as well as water production in Arizona watersheds. (Crouse-Arizona)
W70-02422

THE SOILS OF THE TRUCIAL STATES: CLASSIFICATION AND CAPABILITY,
Durham Univ. (England). Dept. of Geography.
J. H. Stevens.
International Congress of Soil Science, 9th, Adelaide, Australia, Vol 4, p 253-260, 1968. 3 fig, 6 ref.

Descriptors: *Arable lands, *Arid lands, *Soil properties, *Land classification, *Soil classifications, Land reclamation, Surveys, Soil surveys, Soil physical properties, Soil chemical properties, Soil types, Soil investigations, Sierozems, Soil horizons, Saline soils, Alkaline soils.
Identifiers: *Arabian Peninsula, *Land capability, Trucial States.

The Trucial States, located on the arid Arabian Peninsula, are made up of five major physiographic regions. The southern part of the Oman Hills is formed of metamorphic and basic igneous rocks. To the west are the Central Gravel Plains formed by outwash from the hills. The author reports the results of a soil survey of the Gravel Plains conducted as a part of a water resources survey. The soils range from saline-alkali soils to sierozems and nonsaline-alkali soils and are subdivided on the basis of texture, calcium carbonate content, and depth of gravel horizons. Their properties are discussed in this contribution. The aim of the survey was to evaluate areas which could profitably be used for irrigated agriculture. Assuming availability of adequate water, soil qualities, particularly the presence of gravel horizons, are the limiting factors. The area is divided into land capability classes. The soils with gravel phases are assigned to the lowest capability classes. The heavy textured sierozems with a carbonate content of 25 - 50% are always classified as suitable for arable development. (Crouse-Arizona)
W70-02423

SOIL AND SALINITY FACTORS IN IRRIGATION AND DRAINAGE OF MALLEE LANDS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
F. Penman.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol I, p 415-423, 1968. 3 tab, 24 ref.

Descriptors: *Salinity, *Arid lands, *Soil chemical properties, *Irrigation practices, *Drainage systems, Soil-water-plant relationships, Soils, Evaporation, Irrigation effects, Boron, Iron compounds, Iron, Leaching, Salts, Saturated soils, Irrigated land, Alkaline soils.
Identifiers: *Australia, Zinc.

There are extensive areas of Mallee land (solonized brown soils) in southeastern Australia. Some of this soil lying close to the River Murray is irrigated. Rainfall averages 10 to 13 inches annually with a yearly evaporative potential of 60 inches from a free water surface. The soil is typically alkaline with pH values up to 10 or above. Under irrigation these soils are subject to waterlogging and salinity with high boron concentrations occurring in some areas. Availability of zinc and iron is depressed in saline-sodic soils. Waterlogging and salinity have been successfully alleviated by artificial underdrainage, but leaching of boron is a slow process. Zinc compounds are applied in orchards and vineyards. Iron deficiency chlorosis is successfully controlled by the use of chelated iron. There is still a problem in irrigation practices of overloading the drainage systems. Sprinkler irrigation is recommended since it allows better control of the volume and distribution of irrigation water. Where furrow irrigation is still used, shortened lengths of irrigation runs are recommended. (Crouse-Arizona)
W70-02425

THE SIGNIFICANCE OF THE EXTERNAL WATER POTENTIAL AND OF SALT TRANSPORT TO WATER RELATIONS IN PLANTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
J. J. Oertli.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 1, p 95-107, 1968. 1 tab, 6 fig, 18 ref.

Descriptors: *Soil-water-plant relationships, *Soil water movement, *Saline soils, *Plant physiology, *Plant growth, Soil chemical properties, Salinity, Arid lands, Turgidity, Moisture stress, Osmotic pressure, Barley, Corn (Field), Equations, Salts, Leaves.
Identifiers: *Water potential, *Salt transport.

Salinity in soil water frequently occurs under arid conditions. Presence of solutes in soil water at the root surface affects plant behavior. These solutes can be taken up into plant tissues and changes in osmotic pressures in the leaf sap occur which eventually bring an apparent adjustment in plant-water relations to external osmotic moisture stress. Nevertheless, a reduction in plant growth occurs under saline conditions. This paper is intended to aid in the interpretation of the water potential at the root surface, with the help of a plant model restricted to those aspects which seem particularly important. The author presents a theoretical discussion of effects of water potential and turgor pressure on cell elongation and discusses vacuolar

and extracellular solute relationships. Supporting experimental evidence from corn and barley seedlings is presented. It is evident that the adjustment of turgor pressure in the elongating cell takes more time under saline conditions because of the characteristics of salt transport. Salt burns may be the result of extracellular salt accumulations. Plant growth response to saline soil water can only partially be explained by the energy status of the external water. Static and dynamic aspects of both intra- and extracellular solutes must also be considered. (Crouse-Arizona)
W70-02426

PRELIMINARY STUDIES OF THE ROLE OF NASUTITERMES EXITIOSUS (HILL) IN THE CYCLING OF ORGANIC MATTER IN A YELLOW PODZOLIC SOIL UNDER DRY SCLEROPHYLL FOREST IN SOUTH AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Dept. of Soils.
K. E. Lee, and T. G. Wood.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 3, p 11-18, 1968. 3 tab, 16 ref.

Descriptors: *Soil chemical properties, *Organic matter, *Forest soils, *Semiarid climates, *Cellulose, Nitrogen, Soils, Wood wastes, Soil horizons, Biochemistry.
Identifiers: *Australia, *Termites, *Cycling.

Organic matter is usually relatively low in soils of arid and semiarid regions. The authors report a study made on the role of termites in incorporation and cycling of organic material in a semiarid woodland in southern Australia. Nasutitermes exitiosus (Hill) is a mound building species, common throughout southern Australia, which eats dead wood and incorporates its excretory products into its mounds and subterranean galleries. 311 kg/ha of organic material were found in termite mounds in the area studied. These mounds are occupied for as long as 50 years and remain for many more after abandonment. Thus, it was found that a quantitatively significant proportion of the total organic matter of the ecosystem was affected by termites. This differs from the situation in soils in other areas where activities of soil animals tend toward rapid incorporation of dead organic material in the upper soil horizons. (Crouse-Arizona)
W70-02427

DYNAMICS OF SALINITY AND CATION EXCHANGE EQUILIBRIA IN SOME IRAQI SOILS,
Agricultural Radioisotope Lab. (Iraq); and Alexandria Univ. (Egypt).
A. Kadow, Fathi Amer, and L. Kadri.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 1, p 721-729, 1968. 2 tab, 2 fig, 12 ref.

Descriptors: *Arid lands, *Salinity, *Groundwater, *Cation exchange, *Soil chemical properties, Arable land, Irrigation water, Soils, Soil water movement, Alkalinity, Chlorine, Sodium, Bicarbonates, Calcium, Magnesium, Calcium carbonate, Salts.
Identifiers: *Iraq.

Most land in central and southern Iraq is submarginal for cultivation owing to high salinity. The authors report a study of the dynamics of salinity in four different Iraqi soil profiles where salt accumulation was due to capillary rise from groundwater or accumulation from irrigation water. In making the analyses it was assumed that the entire Cl content of groundwater remained in the soil solution. It was found that about 90% of the variance in ESR (exchangeable sodium ratio) could be accounted for by variance in SAR (sodium adsorption ratio) when the effects of the anion species were considered separately. SAR was found to increase as the sample sites moved toward the south. Na in the capillary stream caused a partial replacement of exchangeable Ca and Mg. The differential translocation of Mg as soluble Mg (HCO sub 3)sub 2 was increased by presence of HCO sub 3 super - and favored inactivation of Ca as CaCO sub 3. The Gapon constant for the exchange equilibrium between Ca and Mg was generally greater than unity, but did vary for the different soils. (Crouse-Arizona)
W70-02430

THE REDISTRIBUTION OF THE MORE SOLUBLE CHEMICAL ELEMENTS ASSOCIATED WITH SOILS AS INDICATED BY ANALYSIS OF RAIN-WATER, SOILS AND PLANTS,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
For primary bibliographic entry see Field 02A.
W70-02431

SALTING IN IRRIGATION AREAS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Soils.
G. N. Evans.
Chiasma, Armidale, No 6, p 113-115, 1968. 2 fig.

Descriptors: *Arid lands, *Salinity, *Groundwater, *Irrigated land, *Drainage, Saline soils, Groundwater movement, Hydrology, Evapotranspiration, Irrigation practices, Saline water, Salts, Evaporation, Damages, Water table.
Identifiers: *Australia, *New South Wales.

Throughout the history of irrigated agriculture many arable acres have been put out of production by salinity. This is especially true in arid areas of the ancient world. As agriculture now moves into more arid lands, such as interior southern Australia, it is increasingly important that the possibility of salting damage be assessed and avoided through careful planning and management. The author reviews processes by which salinity occurs and sources of salts. These are developed with examples from the Hawkesbury River Flats in New South Wales, Australia. The author concludes that salting problems can be avoided by careful selection of suitable irrigation sites, irrigation management and good drainage. (Crouse-Arizona)
W70-02433

SALINIZATION OF SOILS OF PIEDMONT PLAINS,
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
V. V. Egorov.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 1, p 437-441, 1968.

Descriptors: *Salinity, *Drainage, *Drainage systems, *Arid lands, *Soil physical properties, Groundwater, Groundwater movement, Permeability, Water table, Soil chemical properties, Reclamation, Drainage density, Soil structure, Evaporation, Geomorphology, Saline soils, Salts, Hydrogeology, Irrigation effects, Leaching.
Identifiers: *USSR, *Piedmont plains.

The USSR has vast arid lands that can be used for agriculture only with irrigation. Despite years of experience, development of new lands and sometimes use of older irrigated lands are hindered by salinization of the soils. The author discusses the particular problems inherent in developing new lands in the piedmont plains of Middle Asia and eastern Transcaucasia. Methods of salinity control developed for older areas cannot always be transferred to the piedmont because structure of the piedmont plains is more complex than previously presumed. At the end of each concealed step of the piedmont there are textural changes which impede subsurface flow of water. Thus, inadequate drainage and secondary pressure result, retarding the leaching of soil salts. Vertical drains are recommended to reduce or eliminate groundwater pressure. Because of low permeability of soils on deluvial trains of the piedmont plains, horizontal drains are needed for removal of salt solutions and for lowering the groundwater table. Spacing should vary according to severity of the salinity problem and structural peculiarities of the particular area. (Crouse-Arizona)
W70-02434

SOME FEATURES OF ANTARCTIC SOILS AND THEIR RELATION TO OTHER DESERT SOILS,
Department of Scientific and Industrial Research, Wellington (New Zealand). Soils Bureau.
For primary bibliographic entry see Field 02C.
W70-02437

THE SALTING FACTORS OF IRRIGATED SOILS IN THE TURAN PLAIN,
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
V. M. Borovskiy.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 1, p 473-481, 1968. 19 ref.

Descriptors: *Salinity, *Evaporation, *Drainage, *Irrigated land, *Groundwater, Saline water, Salt balance, Soil chemical properties, Soils, Capillary action, Irrigation practices, Salts, Saline soils, Soil physical properties, Arid lands, Deserts, Hydrologic properties.
Identifiers: *USSR, *Turan Plain.

Over 60% of irrigated lands in the USSR are located on the Turan Plain of Central Asia and South Kazakhstan. The area produces over 90% of the cotton in the USSR as well as other crops. 75% of the soils are subject to secondary salinization. This is not true of the remaining area which has naturally adequate drainage. Careful regulation of the water-salt system through well planned irrigation practices is essential to preventing destruction of arable land by salinization. The main source of these salts is from groundwater. In developing proper irrigation practices for each area, consideration must be given to hydrologic properties of the entire profile from surface to groundwater table, nature of the soils, terrain, and nature of the groundwater. The author presents a general discussion of physical and chemical characteristics which cause a real danger of secondary salinization of the Turan Plain unless adequate precautions are taken. (Crouse-Arizona)
W70-02439

WATER REPELLENT SANDS,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
R. D. Bond.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 1, p 339-347, 1968. 4 fig, 11 ref.

Descriptors: *Impervious soils, *Infiltration, *Sands, *Wettability, *Pastures, Soil physical properties, Germination, Plant growth, Soil-water-plant relationships, Soils, Organic compounds, Arid lands, Capillary action, Semiarid climates, Soil moisture.
Identifiers: *Australia, Contact angle.

This paper reports field investigations of water repellent sandy soils in South Australia. In arid or semiarid lands where soil moisture for plant growth is already limited by the climate, soils of a water repellent nature cause further difficulties in even infiltration of the limited rainfall and subsequent uneven germination and poor growth of range and pasture grasses. Water repellence is caused by organic coatings which prevent water films from spreading over soil particles since the advancing contact angle of wetting with water is frequently greater than 90 degrees. Observations showed that the degree of water repellence varied with type and age of plant cover. (Crouse-Arizona)
W70-02440

EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
All-Union Scientific-Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
V. E. Bobchenko, and A. A. Sydko.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 1, p 443-453, 1968. 2 tab, 3 fig.

Descriptors: *Salinity, *Leaching, *Desalination, *Semiarid climates, *Economic feasibility, Saline soils, Drainage systems, Soil-water-plant relationships, Loess, Irrigation practices, Drainage effects, Salts, Groundwater, Evaporation, Irrigation effects, Crop production, Cotton, Arid lands.
Identifiers: *USSR, *Golodnaya Steppe.

The Golodnaya Steppe, located in the Middle Asian part of the USSR is characterized by a hot, dry climate. Semiarid loess soils prevail. They are suitable for irrigation except for excessive salinity resulting from a high evaporative potential and shallow groundwater. The authors conducted research to develop a method for rapid desalinization to reclaim these soils. Drainage was provided to lower the water table and leaching was started at rates of 8.2 to 71x10 super 3 cubic meters/ha. Over a period of 1 - 5 months the soils were leached to a depth of 0.7 to 9.5 m. Residual salts within this depth were well below the safe limit. Data showed that faster leaching rates required increased amounts of fresh water per unit of salt removal. High leaching rates were not economically feasible nor were very low rates, since they did not remove sufficient salts to permit crop yields. The authors conclude that a leaching rate of about 10x10 super 3 cubic meters/day is the economical optimum. Deep drainage and application of irrigation water at sufficient rates prevented secondary salinization. (Crouse-Arizona)
W70-02441

BACTERIAL RESPONSE TO THE SOIL ENVIRONMENT,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 05B.
W70-02442

2H. Lakes

WIND REPRODUCTION AND WINDFLOW MEASURING METHODS USING SPATIAL MODELS (RUSSIAN),
State Hydrological Inst. (USSR).
For primary bibliographic entry see Field 02A.
W70-02233

EPIBENTHIC ALGAL PRODUCTION AND COMMUNITY RESPIRATION IN THE SEDIMENTS OF MARION LAKE,
British Columbia Univ., Vancouver. Dept. of Zoology.
Barry T. Hargrave.
Journal Fisheries Research Board of Canada, Vol 26, No 8, p 2003-2026, 1969. 13 fig, 6 tab, 38 ref.

Descriptors: *Primary productivity, *Sediments, Photoperiodism, Carbon Cycle, Temperature, Light, *Benthic fauna, Benthic flora, Efficiences, Sediment-water interfaces, Lakes, Oxygen, Regression analysis.
Identifiers: *Marion Lake (British Columbia), *Algal production, *Bacterial respiration, *Community respiration, Epibenthic production, British Columbia, Carbon flux, Antibiotics, Macrofaunal respiration, Depth effects.

Author measured gross epibenthic algal production and community respiration by following dissolved oxygen changes over undisturbed sediment cores, and bacterial respiration by measuring difference in total community respiration following addition of antibiotics. Macrofaunal respiration was measured and annual carbon flux was estimated. Oxygen production by epibenthic algae was directly related to temperature, light, and community respiration, and inversely related to day length. Photosynthetic efficiency was estimated at 0.4 to 3.1%, increasing with water depth over sediment. Community respiration was curvilinearly related to temperature, oxygen concentration, and day length. Bacterial respiration constituted 30% of total community respiration in summer and 45% in winter. Macrofaunal and epibenthic algal respiration accounted, respectively, for 33% and 23% of community respiration. Net production was estimated at 85% of gross production for summer. Production of epibenthic algae was estimated as 40 grams carbon/square meter per year. Temperature was most important variable influencing oxygen production and consumption. Author states that primary production on sediments exceeds that of the water column. Tabular data include multiple regression analyses, partitioning of community respiration, annual gross oxygen production, and consumption by depth, and comparisons of Marion Lake data with other published reports. (Voigtlander-Wis)
W70-02244

AUTECOLOGICAL STUDIES ON THE DOMINANT PHYTOPLANKTON SPECIES OF LAKE CHAMPLAIN,
Vermont Univ., Burlington. Dept. of Botany.
Philip W. Cook.
Vermont Resources Research Center, Completion Report, 1969. 2 p. OWRR A-009-VT.

Descriptors: *Phytoplankton, *Lakes, Bioindicators, Water quality, Chlorophyll, Biomass, Vermont.
Identifiers: *Autecology, Lake Champlain (NY-Vt), Shelburne Bay (Vt), Burlington Bay (Vt).

Results are reported of a project initiated to examine the biology of selected dominant species of the phytoplankton which are of potential value as indicators of water quality. Samples were collected at approximately weekly intervals during July-August 1968 from two sites in Lake Champlain (Shelburne Bay and a station located approximately two miles from Burlington Bay). Chlorophyll concentration of freshly collected samples were determined, and other samples were preserved for subsequent enumeration of their phytoplankters, after sand filtration. Values for chlorophyll concentration ranged from 3.5 to 11.4 milligrams chlorophyll/cubic meter. Total numbers of phytoplankters for each sample were well correlated with its chlorophyll concentration. (Eichhorn-Wis)
W70-02247

LIMNOLOGICAL STUDIES IN CONNECTICUT. VIII. THE NIACIN CYCLE IN A SMALL INLAND LAKE,
Yale Univ., New Haven, Conn. Osborn Zoological Lab.
G. E. Hutchinson, and Jane K. Setlow.
Ecology, Vol 27, No 1, p 13-22, Jan 1946. 3 fig, 20 ref.

Descriptors: *Connecticut, *Limnology, *Lakes, Bacteria, Seston, Detritus, Hypolimnion, Phytoplankton, Vitamins, Cyanophyta, Temperature, Lactobacillus, Ice, Chlorophyta, Seasonal, Phosphates, Depth, Epilimnion, Eutrophication, Chlorella, Water pollution sources, Physiological ecology.
Identifiers: *Niacin, Oscillatoria Rileyi, Oscillatoria prolifica, Biotin, Myxophyceae, Linsley Pond (Conn), Lactobacillus arabinosus, Lactobacillus casei, Raphidiopsis, Aphanizomenon gracile, Fragilaria crotonensis, Synedra, Asterionella formosa, Dinobryon, Anabaena, Thiamin, Vertical variation, Antibiotics, Chlorellin.

Concentrations of dissolved niacin in surface waters of Linsley Pond varies from 0.15 to 0.89 gamma/liter. High values (over 0.7 gamma/liter) are found only when ice-cover is present or is breaking up. Sestonic niacin per unit volume of water varies from 0.05 to 0.87 gamma/liter. Living phytoplankton, mostly Oscillatoria, apparently contains 50 to at least 100 gamma niacin/gram. Vertical variations in niacin content of unfiltered water, sampled during full summer stratification, depend primarily on variation in sestonic niacin. Seston from lower hypolimnion, presumably largely detritus, contains 22 gamma niacin/gram of total dry matter, or 33 gamma/gram of dry organic matter. Concentrations of dissolved biotin in Linsley Pond probably vary between 0.0003 gamma/liter and 0.004 gamma/liter, and sestonic biotin, over the same general range. No antibiotic substance, active against bacteria, was detected in either Linsley or Bantam Lake at end of spring phytoplankton bloom. Authors suggest that the general course of niacin decomposition by bacteria in lakes is similar to that in soils, and that such auxo-heterotrophic phytoplankters as occur in lakes will prove to be winter species. (Jones-Wis)
W70-02250

ESTIMATIONS OF PHYTOPLANKTON PRODUCTION AND BIOMASS IN A SMALL ACID BOG LAKE,
Wisconsin Univ., Madison. Dept. of Zoology.
Joseph F. Koonce.
MS Thesis, Wisconsin Univ, Madison, 1969. 63 p. 12 fig, 4 tab, 87 ref.

Descriptors: *Phytoplankton, *Productivity, *Biomass, *Acidic water, *Bogs, *Lakes, Photosynthesis, Nannoplankton, Chrysophyta, Chlorophyta, Hydrogen ion concentration, Stratification, Conductivity, Sampling, Carbon dioxide, Chlorophyll, Organic compounds, Dissolved oxygen, Carbon radioisotopes, Diurnal, Fluctuation, Primary productivity, Electrical conductance, Bicarbonates, Alkalinity, Ions, Temperature, Light intensity, Euglenophyta, Dystrophy, Nutrients, Wisconsin, Oligotrophy, Cyanophyta, Diatoms.
Identifiers: Lake Geri (Wis), Flagellates, Dinophyceae, Desmids, Vilas County (Wis), Penney Lake (Wis), Peridinium limbatum, Peridinium cinctum, Peridinium inconspicuum, Oocystis solitaria, Cosmarium bioculatum, Ochromonas, Chrysococcus rufescens, Cryptophyceae, Bacillariophyceae, Myxophyceae, Depth effects.

An attempt was made to quantify the contribution of nannoplankton to biomass of an acid bog lake and to correlate biomass with production. A small bog pond in northern Wisconsin, Lake Geri, was selected for study. Two methods were used to estimate production uptake of carbon dioxide as indicated by diurnal changes in electrical conductance over the entire water column at four stations in the pond. A gross photosynthesis of 69 milligrams carbon/square meter per hour was measured on 12 September 1968. Phytoplankton of the pond consisted mainly of nannoplankton, and flagellates accounted for 70-89% of the total biomass. At least 25 species, with cellular volumes ranging between 1 and 32, 000 cubic micra, occurred in Lake Geri during period of study. Dinophyceae, Chrysophyceae, and Chlorophyceae, contributed importantly--in that order--to phytoplankton of the pond. Desmids were highly diversified and Nygaard's compound composition index for pond was 0.83. Average total biomass for water column of 3 meters ranged between 4.1 and 2.4 grams/cubic meter. (Jones-Wis)
W70-02252

A PHYTOPLANKTON BLOOM IN WESTERN LAKE ERIE,
Public Health Service, Cleveland, Ohio.
Victor L. Casper.
Michigan Univ, Ann Arbor, Great Lakes Research Division, Publication No 13, p 29-35, 1965. 2 fig, 3 tab, 11 ref.

Descriptors: *Phytoplankton, *Eutrophication, *Lake Erie, Cyanophyta, Sampling, Dissolved oxygen, Nitrogen, Nitrates, Lakes, Diatoms, Chlorophyta, Seasonal, Chemical stratification,

Phosphorus, Climatic data, Hydrogen ion concentration, Alkalinity, Conductivity, Chemical oxygen demand, Physical properties, Temperature, Surface waters, Photosynthesis, Respiration, Light penetration, Productivity, Biochemical oxygen demand, Organic matter, Nitrogen fixation, Water pollution effects.
Identifiers: Anacystis cyanea, Oscillatoria, Carteria, Aphanizomenon holsaticum, Anabaena circinalis, Detroit River, Maumee River, Cladophora, Stephanodiscus, Bottom, Glenodinium, Cyclotella, Chlamydomonas, Depth effects.

Lake Erie exhibits symptoms of organic enrichment; temporal shifts in dominant algal genera, from diatoms to greens and blue-greens (cyanophytes) are occurring. On 9 and 10 September 1964, biologists at Great Lakes-Illinois River Basins Project's Lake Erie Program Office investigated a bloom of cyanophytes in western Lake Erie. The bloom, consisting primarily of Anacystis cyanea, Oscillatoria sp, Carteria sp, Aphanizomenon holsaticum, and Anabaena circinalis, covered approximately 800 square miles. Plankton and chemical samples were collected from top, middle and bottom depths, and color photographed. Extreme vertical variations in biological and chemical parameters often occur. During the bloom, total nitrogen (N) was high, and nitrate-N very low. Inorganic N has probably become limiting for phytoplankton production; high concentrations of soluble phosphorus suggest that it was not limiting. During the day dissolved oxygen was at saturation or above. Plankton counts were quite variable. In early morning, algae were well dispersed top to bottom due to light wind, but by afternoon they were concentrated in upper two feet, forming a dense scum. On 11 September, high winds, together with a cold front and rain, were followed by several cloudy days, and the bloom was not observed again. (Jones-Wis)
W70-02254

EXPERIMENTAL STUDY OF WARM WATER FLOW INTO IMPOUNDMENTS. PART I: FLOW AND HEAT EXCHANGE NEAR A SURFACE OUTLET IN TWODIMENSIONAL FLOW,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Heinz Stefan, and F. R. Schiebe.
Available from the Clearinghouse as PB-188 512, $3.00 in paper copy, $0.65 in microfiche. Project Report No 101, Dec 1968. 72 p, 17 fig, 11 ref, 4 append. FWPCA Contract WP-913-04.
Identifiers: *Thermal stratification, Impoundments, *Cooling water, Thermal pollution, Stratified flow, *Outlets, Discharge (Water), Water temperature, Heat flow.

Information on some of the processes producing temperature and velocity distribution when heated water is discharged from a channel into a deep impoundment was obtained in laboratory experiments using a 40 ft long, 0.5 ft wide, 1.2 ft deep glass-walled flume. Dimensionless parameters and control mechanisms which produce various forms of stratification near the outlet were investigated specifically. Velocity and temperature distributions were measured in vertical cross sections at various distances from the outlet. Formation of stable stratification was observed using dye.
W70-02393

EXPERIMENTAL STUDY OF WARM WATER FLOW INTO IMPOUNDMENTS. PART II: TEMPERATURE AND VELOCITY INSTRUMENTATION AND DATA PROCESSING FOR THE THREE DIMENSIONAL FLOW EXPERIMENTS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Frank R. Schiebe, Heinz Stefan, and Norio Hayakawa.
Available from the Clearinghouse as PB-188 513, $3.00 in paper copy, $0.65 in microfiche. Project Report No 102, Dec 1968. 55 p, 13 fig, 1 tab, 3 ref, 3 append. FWPCA Contract WP-913-04.
Identifiers: *Thermal stratification, *Instrumentation, *Velocity, Current meters, *Water temperature.

A combination of a thermistor probe and a buoyant tethered sphere was developed to measure the temperature and velocity fields in a thermally stratified flow in a laboratory experiment. The velocity probe is able to measure velocities from 0.01 to 0.2 fps. Velocities are derived from the magnitude and the direction of the sphere deflection. The methods of data acquisition and data processing are described. Flow charts are included.
W70-02394

EXPERIMENTAL STUDY OF WARM WATER FLOW INTO IMPOUNDMENTS. PART III: TEMPERATURE AND VELOCITY FIELDS NEAR A SURFACE OUTLET IN THREE-DIMENSIONAL FLOW,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Heinz Stefan, and F. R. Schiebe.
Available from the Clearinghouse as PB-188 514, $3.00 in paper copy, $0.65 in microfiche. Project Report No 103, Dec 1968. 105 p, 36 fig, 1 tab, 7 ref. FWPCA Contract WP-913-04.
Identifiers: *Thermal stratification, Impoundments, Lakes, *Cooling water, Thermal pollution, Stratified flow, *Outlets, Discharge (Water), Water temperature, Heat flow.

Information on some of the physical processes producing temperature and velocity distribution when heated water is discharged from a channel into a wide and deep impoundment was obtained in several laboratory experiments. Both the outlet channel and the receiving tank had rectangular cross sections, but the tank was more than thirty times wider and deeper than the channel. Measurements of local velocities were made with a tethered buoyant sphere. Temperatures were also measured and some surface spreading patterns were recorded photographically. Investigated densimetric Froude numbers and Reynolds numbers at the outlet ranged from 0.6 to 7.2 and from 1500 to 9600, respectively.
W70-02395

THERMO-HYDRODYNAMICS OF STREAMS AND RESERVOIRS - GRAPHICAL METHOD FOR THE PREDICTION OF WATER TEMPERATURES WITHIN AND DOWNSTREAM FROM RESERVOIRS.

TVA, Division of Water Control Planning, Engineering Laboratory, Laboratory Report No 1, Aug 1967. 3 fig, 7 ref.

Descriptors: *Thermal stratification, *Water temperature, *Reservors, Heat budget, Isotherms, Thermal conductivity, Thermocline, Tennessee Valley Authority Project, Dissolved oxygen, Mixing, Thermal properties.

Graphical solution of stratification in reservoirs is presented based on the following assumptions: (1) water temperature is the only factor determining the density of water; (2) the heat exchange between the reservoir surface and the climatic environment takes place only in a 10-foot surface layer; (3) the temperature of this layer corresponds to the equilibrium temperature and can be computed from the heat budget equation; (4) each small water parcel incoming into the reservoir spreads out into a horizontal layer at its corresponding temperature; (5) no change of temperature and no mixing occurs between inflow water and reservoir water; (6) the withdrawal of water is assumed to affect only a layer between the bottom and top of the intake; (7) water is withdrawn from the horizontal layer extending over the whole area of the reservoir at intake level; and (8) the body of water becomes gradually homogeneous between the surface temperature and the corresponding isotherm at depth z in the fall. The method developed for temperature stratification prediction can be extended to dissolved oxygen distribution. (Novotny-Vanderbilt)
W70-02397

THERMAL REQUIREMENTS TO PROTECT AQUATIC LIFE IN TEXAS RESERVOIRS,
Texas Electric Service Co., Fort Worth.
For primary bibliographic entry see Field 05B.
W70-02400

HYDROBIOLOGICAL INVESTIGATIONS ON THE IMPOUNDMENT RESERVOIR AT GOCZALKOWICE (GERMAN),
K. Starmach.
Verh, Internat Verein Limnol, Vol 14, p 643-646, July 1961.

Descriptors: *Biological properties, *Reservoirs, *Impoundments, *Plankton, Temperature, Aquatic environment, Plant growth, Fish, Ecology, Water quality, Aquatic algae, Zooplankton, Bacteria.

The impoundment reservoir Goczalkowice was constructed from 1951-56. The drainage area is about 739 sq km and is located mainly in mountain area (Carpaten). The municipal and industrial pollution coming into this reservoir is not yet significant. The average summer temperature of air is about 15 deg C within the 60 to 70-day period and the average daily temperature in winter is below zero about 100 days. Biological investigations have been pursued since 1955 and the results are presented with corresponding chemical characteristics. (Novotny-Vanderbilt)
W70-02404

PRELIMINARY REPORT OF TEMPERATURE AND OXYGEN UPTAKE IN THE LAKE SCHLIERSEE IN 1956 (GERMAN),
F. Wilhelm.
Limnol Schriftenreihe, Vol 5, No 19, p 40-65, 1958. 31 ref.

Descriptors: *Temperature, *Lakes, Heat balance, Thermal properties, Thermal stratification, Thermocline, Epilimnion, Hypolimnion, Dissolved oxygen, Heat, Limnology, Oxygen, Thermometers, Energy transfer.

The temperature and dissolved oxygen conditions of the lake from the standpoint of mixing and heat exchange (energy exchange) due to seasonal changes are described. The wind effect on temperature currents is taken into account. A strongly mixed epilimnion and then strongly mixed upper part of the hypolimnion are established, and below them, the relatively quiet hypolimnion exists. The energy exchange also influences the formation of the temperature gradient between the epilimnion and the hypolimnion. In the northern part of the lake, the influence of a tributary is noted and very low concentrations of oxygen were observed in the hypolimnion layers during the summer period. (Novotny-Vanderbilt)
W70-02406

EFFECTS OF IMPOUNDMENTS ON WATER QUALITY,
Tennessee Valley Authority, Chattanooga. Div. of Health and Safety.
M. A. Churchill, and W. R. Nicholas.
Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol 93, No SA6, p 73-90, Dec 1967. 10 fig, 1 tab, 7 ref.

Descriptors: *Impoundments, *Dissolved oxygen, *Thermocline, *Stratification, Water storage, Water quality, Eutrophication.
Identifiers: Tennessee River Reservoirs, Multiple regression technique.

Changes occurring in the quality of water during its passage through Tennessee River reservoirs and during lengthy storage in tributary impoundments

are observed. Seasonal variations of temperatures of water discharges from main-river impoundments are discussed. DO concentrations in the water discharged from main-river reservoirs recede during the summer months but do not reach low concentrations observed below storage impoundments. Both total coliform and fecal coliform concentrations in main-stream reservoirs increase greatly below local municipalities. In tributary storage impoundments strong thermoclines develop in early spring, and relatively cool water, low in DO, is discharged through low-level power intakes well into or throughout the summer. Low DO concentrations are also caused by biological activity in eutrophic impoundments, inflows to which are otherwise relatively free of pollution. A multiple regression technique is used to develop an equation for predicting DO concentrations to be expected in releases from a proposed impoundment. (Rietveld-Vanderbilt)
W70-02411

2I. Water in Plants

THE SIGNIFICANCE OF THE EXTERNAL WATER POTENTIAL AND OF SALT TRANSPORT TO WATER RELATIONS IN PLANTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02G.
W70-02426

ATRIPLEX POLYCARPA: II. GERMINATION AND GROWTH IN WATER CULTURES CONTAINING HIGH LEVELS OF BORON,
California Univ., Riverside. Dept. of Agronomy; and California Univ., Riverside. Dept. of Soils and Plant Nutrition.
N. J. Chatterton, C. M. McKell, J. R. Goodin, and F. T. Bingham.
Agronomy Journal, Vol 61, p 451-453, May-June 1969. 2 fig, 10 ref.

Descriptors: *Boron, *Southwest U.S., *Germination, *Plant growth, *Forages, Arid lands, Soil chemical properties, Desert plants, Ranges, Crop response, Plant populations, Seeds, Toxicity, Resistance.
Identifiers: *Desert saltbush.

Some of the arid soils of the southwestern U.S. have relatively high boron levels. A plant tolerant to boron might be a potentially valuable forage crop for arid range lands. The authors report a greenhouse study of boron tolerance of Atriplex polycarpa (desert saltbush), a shrub native to southwestern deserts. Germination was not affected by boron; growth varied among populations but generally was not affected by boron concentrations in culture solutions up to 40 ppm. Growth was somewhat reduced at 80 ppm. (Crouse-Arizona)
W70-02438

2J. Erosion and Sedimentation

BEACH LAMINATION: NATURE AND ORIGIN,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02L.
W70-02057

SUSPENDED SOLIDS MONITORING: A COMPARISON BETWEEN THREE INSTRUMENTS,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 07B.
W70-02067

HYDRAULICS OF LARGE BED ELEMENT CHANNELS,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 08B.
W70-02070

HYDRAULIC EQUIVALENCE OF MINERALS WITH A CONSIDERATION OF THE REENTRAINMENT PROCESS,
Geological Survey, Fort Collins, Colo.
Neil S. Grigg, and R. E. Rathbun.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 Price $2.75. Geol Surv Res 1969, Prof Pap 650-B, p B77-B80, 1969. 4 p, 4 fig, 12 ref.

Descriptors: *Sedimentation, *Settling velocity, Deposition (Sediments), Particle shape, Particle size, Sedimentation rates, Suspension, Bed load, Tractive forces, Shear drag, Reynolds number.
Identifiers: *Hydraulic equivalence (Settling rate), Sediment reentrainment.

The concept of hydraulic equivalence has evolved to mean that grains having equal fall velocity tend to be of equivalent hydraulic value. However, calculations based on standard fall-velocity relations and Shields' criterion for critical shear stress suggest that grains having the same fall velocity but different specific gravities will require different shear stresses for initiation of motion. These calculations suggest for grains moving in traction, subject to continuous deposition and reentrainment, that equal fall velocity alone should not be a sufficient criterion to assure that the grains will be of equivalent hydraulic value. (Knapp-USGS)
W70-02074

THE TIME INTERVAL BETWEEN STABILIZATION OF ALPINE GLACIAL DEPOSITS AND ESTABLISHMENT OF TREE SEEDLINGS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W70-02075

MEASUREMENT OF WATER FLOW AND SUSPENDED-SEDIMENT LOAD, BOLINAS LAGOON, BOLINAS, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02L.
W70-02082

SEDIMENT TRANSPORT IN STREAMS IN THE UMPQUA RIVER BASIN, OREGON,
Geological Survey, Portland, Oreg.
C. A. Onions.
Geol Surv Open-file Rep, Feb 1969. 45 p, 1 fig, 2 tab, 2 ref.

Descriptors: *Sediment transport, *Oregon, *Data collections, Streamflow, Sediment discharge, Sediment yield, Bed load, Suspended load, Particle size, Turbidity.
Identifiers: *Umpqua River Basin (Ore).

Tables of a suspended-sediment data collected from 1956 to 1967 at 10 sites in the Umpqua River basin are presented. Computations based on these data indicate that average annual suspended-sediment yields at these sites range from 137 to 822 tons per square mile. Because available data for the Umpqua River basin are generally inadequate for accurate determinations of sediment yield and for the definition of characteristics of fluvial sediments, recommendations are made for the collection and analysis of additional sediment data. (Knapp-USGS)
W70-02097

POSITION OF REGIONAL CARBONATE/NON-CARBONATE BOUNDARY IN NEARSHORE SEDIMENTS ALONG A COAST: POSSIBLE CLIMATIC INDICATOR,
Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.; and Rensselaer Polytechnic Inst., Troy, N.Y. Dept of Geology.
For primary bibliographic entry see Field 02L.
W70-02098

TOPOLOGICAL PROPERTIES OF CHANNEL NETWORKS,
IBM Watson Research Center, Yorktown Heights, N.Y.
J. S. Smart.
Geol Soc Amer Bull, Vol 80, No 9, p 1757-1773, Sept 1969. 17 p, 3 fig, 9 tab, 26 ref.

Descriptors: *River basins, *Topography, *Drainage systems, *Synthetic hydrology, *Statistical methods, Probability, Statistics, Networks, Channel morphology, Stochastic processes.
Identifiers: Drainage basin morphology, Topology, Strahler stream numbers.

There are tow common ways of describing the topological properties of channel networks; one is to provide an exact description that gives all junctions and sources in sequence, and the other is to specify the Strahler stream numbers. For many purposes, the first method is too detailed and the second too broad. An intermediate method of classification, called 'ambilateral,' is proposed. The basic rule of this classification scheme is that two topologically distinct channel networks (TDCN) belong to the same class if one can be converted into the other by reversal of the right-left order at one or more junctions. Calculations based on an idealized model suggest that the ambilateral classification is more closely correlated with geomorphic and hydrologic properties than is the usual stream-number classification. Most tests for randomness require that the sample of networks be selected without regard to order, a condition that is not satisfied by much of the published data. In order to obtain a suitable sample, 86 networks ranging in magnitude from 23 to 1172 were determined from stream systems in the United States. The statistical analyses generally support Shreve's hypothesis of topological randomness. (Knapp-USGS)
W70-02101

A PROGRAM TO CALCULATE THE CHANGES OCCURRING IN THE BOTTOM AND THE WATERSHED OF A RIVER CARRYING A BED LOAD (FRENCH),
Bundesanstalt fuer Wasserbau, Karlsruhe (West Germany).
For primary bibliographic entry see Field 08B.
W70-02103

PROBLEMS OF BED LOAD TRANSPORT IN FRENCH WATERWAYS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
For primary bibliographic entry see Field 08B.
W70-02104

SAND TRANSPORT STUDIES RELATED TO THE CANALIZATION OF THE LOWER RHINE,
Netherlands Rijkswaterstaat, Arnhem; and Waterloopkundig Laboratorium, Delft (Netherlands).
For primary bibliographic entry see Field 08B.
W70-02105

SEDIMENTATION AND SEDIMENTATION PROBLEMS OF THE MONDEGO RIVER,
Direccao Geral dos Servicos Hidraulicos, Lisbon (Portugal); and Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 08B.
W70-02107

CANAL SHOALING STUDIES,
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W70-02108

MODEL STUDY FOR THE PREVENTION OF SHOALING AT THE ENTRANCE AND EXIT OF ATHER-EL-NABI NAVIGATION CHANNEL.
Ministry of Irrigation (Egypt). Delta Barrage.
For primary bibliographic entry see Field 08B.

W70-02109

MECHANICS OF BED FORMATIONS,
Robert Coll., Istanbul (Turkey).
For primary bibliographic entry see Field 08B.
W70-02149

EROSION FROM ABANDONED COAL-HAUL ROADS,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04D.
W70-02215

CALCULATION OF ALONG-THE-SHORE TRANSPORT OF SEDIMENTS IN ESTIMATING SHORELINE CHANGES OF RESERVOIRS (RUSSIAN),
Volga River Hydrometeorological Observatory.
For primary bibliographic entry see Field 02L.
W70-02230

TRANSPORT VELOCITY OF SUSPENDED PARTICLES OF VARIOUS SIZES IN HORIZONTAL FLOWS (RUSSIAN),
V. I. Matyukhin, and O. N. Prokof'yev.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii, No 7, p 146-150, 1967. 5 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Sediment transport, *Hydraulic models, *Particle size, *Streamflow, *Velocity, Suspended load, Suspension, Model studies, Photometry, Colorimetry, Flow measurement, Sands, Computers.
Identifiers: *USSR, Suspended-particle velocity transfer.

Horizontal transport of suspended particles of various sizes by streamflows was investigated by using an experimental device consisting of two concentric cylinders and photoelectric and electronic detecting and recording elements. The transport data were obtained by using sands of various sizes and concentrations suspended in the streamflow. The study shows that particles are transported by horizontal streamflow with a velocity equal to the streamflow velocity, if the velocity is in a 120-700 m/hr interval. (Gabriel-USGS)
W70-02231

SUMMARY OF RESERVOIR SEDIMENT DEPOSITION SURVEYS MADE IN THE UNITED STATES THROUGH 1965,
Agricultural Research Service, Oxford, Miss.
F. E. Dendy, and W. A. Champion.
Prepared under the auspices of the Water Resources Council, Committee on Sedimentation, US Department of Agriculture, Miscellaneous Publication 1143, p 1-64, May 1969. 64 p, 1 map, 3 tab.

Descriptors: *Deposition (Sediments), *Reservoir silting, Water storage, Reservoir storage, Watershed management.

Data from known reliable reservoir sedimentation surveys made in the United States through 1965 are summarized in this bulletin. Additional data from surveys made after 1965 are included for a few reservoirs. The reservoirs are located in all of the 48 conterminous United States, except Maine and Florida, and in Puerto Rico. In addition to data on storage reservoirs and ponds, some information on debris basins is included. Information in this bulletin and in the supplement should prove useful to engineers and watershed planning specialists in private and public practice who are concerned with problems of reservoir sedimentation.
W70-02262

SEDIMENT PARAMETERS AND ENVIRONMENT DISCRIMINATION: AN APPLICATION OF MULTIVARIATE STATISTICS,
Toronto Univ. (Ontario); and Scarborough Coll., Toronto (Ontario). Dept. of Geography.
Brian Greenwood.
Canadian J Earth Sci, Vol 6, No 6, p 1347-1358, Dec 1969. 12 p, 8 fig, 5 tab, 62 ref.

Descriptors: *Sands, *Beaches, *Dunes, *Sedimentary structures, *Statistical methods, Correlation analysis, Sampling, Regression analysis, Ripple works, Erosion, Deposition (Sediments).
Identifiers: Factor analysis, Discriminant analysis.

Multivariate discriminant analysis is shown to be a useful tool in delineating sedimentary environments on the basis of quantitative sediment properties. Size-frequency statistics calculated by moments provide environmental indicators for beach and aeolian sands from Barnstaple Bay, England. Linear discriminant analysis proves useful in classifying sediments of unknown origin and of varied mineralogical composition. (Knapp-USGS)
W70-02303

HYDROLOGY ANNUAL NO. 14 - 1966.
Ministry of Works, Wellington (New Zealand).
For primary bibliographic entry see Field 02E.
W70-02307

LABORATORY THEORY AND METHODS FOR SEDIMENT ANALYSIS,
Geological Survey, Washington, D.C.
Harold P. Guy.
Available, Supt Documents, US Government Printing Office, Washington, DC-Price $0.65. Geol Surv Tech Water-Resources Invest, Book 5, Chapter C1, 1969. 58 p, 18 fig, 7 tab, 21 ref.

Descriptors: *Analytical techniques, *Sedimentology, *Sediments, Particle size, Suspended load, Bed load, Particle shape, Mineralogy, Specific gravity, Organic matter, Dissolved solids, Sieve analysis, Settling velocity, Theoretical analysis.
Identifiers: *Sediment analysis, *Manual series, Suspended sediment, Bed material, VA tube pipet, BW tube-VA tube.

Theories and methods used by the Water Resources Division, U.S. Geological Survey, for analysis of fluvial sediments to determine the concentration of suspended load and the particle-size distribution of both suspended sediments and bed materials are given. Other analyses related to these determinations may include particle shape, mineral content, specific gravity, organic matter, and dissolved solids of the samples, and specific weight of the soils. The evaporation and filtration methods for concentration analysis are discussed. Methods used for particle-size analysis of suspended sediment samples may include the sieve-pipet, the VA tube-pipet, or the BW tube-VA tube. The selection of method depends on the equipment available, the concentration and approximate size of sediment in the sample, and the settling medium used. The choice of method for most bed-material samples is usually limited to procedures suitable for sand or to some type of visual analysis for large sizes. (Carstea-USGS)
W70-02316

MOTION OF SINGLE PARTICLES IN SAND CHANNELS,
Geological Survey, Fort Collins, Colo.
Neil S. Grigg.
Geol Surv Open-file Rep, June 1969. 142 p, 36 fig, 6 tab, 32 ref, append.

Descriptors: *Sediment transport, *Bed load, *Model studies, *Hydraulic models, Statistical methods, Sedimentation, Channel morphology, Turbulent flow, Tracers, Radioisotopes, Stochastic processes, Probability, Regression analysis.
Identifiers: Flume studies.

The motion of single particles over ripple and dune beds was investigated in a laboratory flume. Statistical properties of the step lengths, rest periods and bed profiles were calculated and analyzed. Two bed material sizes were used. The investigation was made possible through the use of single high-activity radioactive particles. Medical tracer particles with specific gravity of approximately 2.65 were used. Median diameters were approximately 0.33 and 0.45 mm. In general, the tracers proved quite satisfactory for studies of this type. The measurement of the statistical properties of particle motion made possible the evaluation of a general two-dimensional stochastic dispersion model developed by Sayre and Conover (1967). It was found that the model predicted well the mean velocity of the centroid of a group of particles but underpredicted the rate of spreading of their concentration distribution. The particle step lengths followed the gamma distribution and the rest periods followed the exponential distribution. The distribution of bed form lengths followed a gamma distribution indicating a relation between step length and bed form length. Previously developed simple models may not be adequate to fully describe particle motion. (Knapp-USGS)
W70-02320

ROADSIDE EROSION SURVEY,
Soil Conservation Service, Madison, Wis.
William M. Briggs.
Soil Conservation, Vol 35, No 2, p 27-28, Sept 1969. 2 p, 1 fig, 2 photo, 1 tab.

Descriptors: *Erosion, *Erosion control, *Highways, *Wisconsin, *Surveys, Soil erosion, Bank protection, Land management, Diversion structures, Check structures, Soil conservation, Soil management, Water control.
Identifiers: Highway erosion.

A survey was made of roadside soil erosion in Wisconsin. Over 21,000 sediment-producing sites on 87,000 miles of road total 3,711 miles of erodible roadside. Town and county roads account for 97% of the erosion. Erosion control recommendations include seeding, mulching, sediment-control structures, and property acquisition. (Knapp-USGS)
W70-02327

CONSERVATION IN A NEW TOWN,
Soil Conservation Service, Hyattsville, Md.
John N. Holeman, and Elmer F. Sauer.
Soil Conservation, Vol 35, No 2, p 35-38, Sept 1969. 4 p, 10 photo.

Descriptors: *Sediment control, *Erosion control, *Construction, *Maryland, Road construction, Building codes, Design, Legislation, Excavation, Mulching, Gabions, Check structures, Riprap, Slope protection, Vegetation establishment.
Identifiers: Columbia (Md).

The sediment control program used in construction of the new town of Columbia, Maryland consists primarily of immediate stabilization of all cleared sites, followed by the earliest possible establishment of binding vegetation. Trees, natural topography, and ground cover are retained wherever feasible for the beauty and protection of each subdivision. Builders are urged to stabilize lots with at least partial seeding or sodding before turning them over to new owners. Check structures are used to control sediment transport in watercourses. Sediment traps and basins are installed downstream from all large cleared areas. Stream banks are protected by gabions and riprap. A sediment control ordinance regulates all construction practices. (Knapp-USGS)
W70-02329

MORPHOLOGY, STRUCTURE, AND EVOLUTION OF A CHANNEL ISLAND IN THE

BARAKAR RIVER, BARAKAR, WEST BENGAL,
Indian Inst. of Tech., Kharagpur. Dept. of Geology and Geophysics.
Swapan Kumar Sarkar, and Sudhir Basumallick.
J Sediment Petrol, Vol 38, No 3, p 747-754, Sept 1968. 8 p, 13 fig, 12 ref.

Descriptors: *Sedimentation, *Erosion, *Geomorphology, *Sedimentary structures, *Channel morphology, Islands, Stratification, Stratigraphy, Sand waves, Currents (Water), Ripple marks, Sand bars, Sands, Gravels, Meanders, Mapping, Flood plains, Silts, Clays.
Identifiers: *India, West Bengal, Barakar River.

The formation of a channel island in the Barakar River of West Bengal was investigated on the basis of a detailed geological study. A number of sedimentary structures were recorded. In order of abundance these structures are as follows: cross-stratification, sand waves, ripple-drift laminae, deformation structures, current crescents, and ripple marks. The occurrence and abundance of these structures is well marked, as is the vertical structural variation. The presence of a clay band almost all over the island at a height of 10-11 feet indicates that the sand bar acted as a temporary flood plain when fine silt and clay were deposited from the suspended load of flood water. It seems that the point bar was evolved into a channel island through an intermediate stage of a channel bar and a temporary flood plain. In general, the growth of the island was due to initial lateral accretion and subsequent vertical accretion. (Gabriel-USGS)
W70-02331

DATA ON CONSOLIDATION OF FINE-GRAINED SEDIMENTS,
University of Southern California, Los Angeles. Dept. of Petroleum Engineering.
George V. Chilingarian, and Herman H. Rieke, III.
J Sediment Petrol, Vol 38, No 3, p 811-816, Sept 1968. 6 p, 4 fig, 2 tab, 32 ref.

Descriptors: *Sedimentation, *Sedimentary rocks, *Diagenesis, *Consolidation, *Water chemistry, Pressure, Moisture, Clay minerals, Montmorillonite, Kaolinite, Salinity, Mud, Permeability, Clays, Organic matter, Calcium, Chlorine, Magnesium, Sodium, Potassium, Sulfates, Ions.
Identifiers: Fine-grained sediment consolidation.

The process of consolidation of fine-grained sediments was investigated on the basis of experiments with pressure versus sediment moisture content. The analysis of pressure-moisture curves leads to the overall conclusion that upward deviations of the curve from linearity are caused by the squeezing out of non-oriented water first. These deviations occur at pressures corresponding to about 20-25% remaining moisture content for kaolinite and 50-70% for montmorillonite, that is, at pressures where the chemistry of the squeezed-out solutions begins to change appreciably. The salinity of interstitial solutions in shales should be less than that of water in associated sandstones, assuming that water was squeezed from the shale into the sandstone. (Gabriel-USGS)
W70-02332

SETTLING CONVECTION AND GRAIN-SIZE ANALYSIS,
Geological Inst., Groningen (Netherlands).
Ph. H. Kuenen.
J Sediment Petrol, Vol 38, No 3, p 817-831, Sept 1968. 15 p, 10 fig, 2 tab, 25 ref.

Descriptors: *Sedimentation, *Convection, *Sediment load, *Settling velocity, Analytical techniques, Density, Vertical migration, Suspension, Saline water, Clays, Silts, Velocity, Compaction, Sea water.
Identifiers: Sediment settling processes.

Grain-size analysis by 'settling convection,' that is, by a system where the difference in density of clouds in a settling suspension generates a settling current, was investigated. Suspensions of silt and clay show active convection due to the development of clouds differing in density. In salt water the suspension density remains roughly constant for a long time while the volume of the suspension decreases. In peptized suspensions with densities between 20 and 0.1/gr/liter, convection is very active. A visual method is described for three-dimensional size measurement of flocculated lutum in sea water. Experiments conducted on elutriation in water (counter-current separation) give poor results in consequence of settling convection. (Gabriel-USGS)
W70-02333

A FLORIDA SABELLARIIDAE REEF AND ITS EFFECT ON SEDIMENT DISTRIBUTION,
Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 02L.
W70-02334

CLAY MINERALOGY OF WEATHERED PRODUCTS AND OF RIVER SEDIMENTS, PUERTO RICO,
Texas Christian Univ., Fort Worth. Dept. of Geology.
Arthur J. Ehlmann.
J Sediment Petrol, Vol 38, No 3, p 885-894, Sept 1968. 10 p, 4 fig, 5 tab, 7 ref.

Descriptors: *Erosion, *Weathering, *Clay minerals, *Rivers, *Puerto Rico, Paleoclimatology, Igneous rocks, Soils, Geology, Rainfall, River systems, Climates, Sands, Topography, Karst, Sampling, X-ray analysis, Petrology, Water analysis, Calcium, Magnesium, Sodium, Potassium, Streamflow.
Identifiers: *Clay mineralogy.

The island of Puerto Rico is composed of an east-west mountain range of andesitic to basaltic volcanics with lesser amounts of calcareous sediments. The stream loads of the islands contain halloysite, gibbsite, quartz, montmorillonite, vermiculite, and relatively-small amounts of chlorite and serpentine. The rivers of Puerto Rico, in general, reflect the climatic conditions present in their watersheds by their characteristic loads; however, because of the small volume of clay relative to the larger volume of mineralogically unstable volcanic sand in the rivers, the bulk sediment being deposited offshore provides only slight indication of climatic conditions onshore. (Gabriel-USGS)
W70-02335

THE FORMATION OF FINE PARTICLES IN SANDY DESERTS AND THE NATURE OF 'DESERT' LOESS,
University Coll., London (England).
I. J. Smalley, and C. Vita-Finzi.
J Sediment Petrol, Vol 38, No 3, p 766-774, Sept 1968. 9 p, 3 fig, 1 tab, 55 ref.

Descriptors: *Loess, *Deserts, *Sands, *Fine aggregates, Aeolian soils, Glaciers, Dust storms, Energy transfer, Deposition (Sediments), Mechanical properties, Mineralogy, Quartz, Air temperature, Stress, Kinetics.
Identifiers: Desert loess.

Loess consists chiefly of quartz particles with diameters of about 20-50 microns. It is commonly thought to have formed in periglacial areas and in deserts. It has been suggested that direct glacial grinding could produce suitable particles. The existence of dust storms suggests that fine particles also form in hot, sandy deserts; these could be the result of interparticle contacts where a certain critical kinetic energy is involved. There are no loess deposits within sandy desert areas, but they may occur at the desert margins. The major loess provinces to which a desert origin has been ascribed either are not true loess or are explicable in terms of glacial origin. Of the minor deposits, only that of the Negev seems to have a well established desert origin. The quartz particles in the Negev deposit probably formed by simple impact. This mechanism does not seem adequate for the Chinese loess, and it is suggested that the widespread Pleistocene glacition of China was responsible for the bulk of the fine particles. Thus although loess particles can form mechanically in deserts, they have not done so on a scale sufficient to produce major loess deposits. Desert loess deposits should be distinguishable from glacial loess deposits by their size and their mineralogical nature. Stresses produced by temperature changes can break rocks. Most quartz is introduced into the sedimentary system as sand-size particles (about 500 microns), smaller than the critical break size. (Gabriel-USGS)
W70-02336

MINERALOGY OF THE SAND SIZE CARBONATE FRACTION OF SOME RECENT MARINE TERRIGENOUS AND CARBONATE SEDIMENTS,
Duke Univ., Durham, N.C. Dept. of Geology; and Duke Univ., Beaufort, N.C. Marine Lab.
For primary bibliographic entry see Field 02L.
W70-02338

PALEOCLIMATOLOGY AND THE RELATIVE STABILITY OF FELDSPAR MINERALS UNDER ATMOSPHERIC CONDITIONS,
California Univ., Davis. Dept. of Geology; and California Univ., Bodega Bay. Bodega Marine Lab.
Thomas W. Wood.
J Sediment Petrol, Vol 38, No 3, p 832-844, Sept 1968. 13 p, 1 fig, 2 tab, 55 ref.

Descriptors: *Weathering, *Erosion, *Mineralogy, *Paleoclimatology, *Stability, Kaolinite, Sodium, Potassium, Hydrogen, Rainfall, Topography, Temperature, Ion transport, Micrometeorology, Electron microscopy, Sampling.
Identifiers: Sacramento Valley (Calif), Eocene sandstone.

The Domengine formation, a middle Eocene sandstone located in the Sacramento Valley of California, was investigated to obtain a broad picture of the climatological-mineral stability relationship. The study of the kaolinitic weathering alteration of feldspar grains of the Valley samples indicates that orthoclase is more weathered than andesine. This process depends on the fact that under active leaching conditions, sodium ion emigration rates from plagioclase feldspar exceed potassium ion migration from orthoclase. Low relief, high non-seasonal rainfall, and subtropical temperatures would produce the required microchemical conditions, and sodium ion activity would be higher in soil water than that of K ion because Kions are continuously incorporated into plant tissues. Under favorable circumstances, gross climatological characteristics of ancient terranes can be deduced from mineralogical evidence. (Gabriel-USGS)
W70-02339

RECENT SEDIMENTS AND DIAGENESIS OF SOUTH BONAIRE, NETHERLANDS ANTILLES,
Shell Oil Co., Midland, Tex.
For primary bibliographic entry see Field 02L.
W70-02340

2K. Chemical Processes

WATER LOAD OF URANIUM, RADIUM, AND GROSS BETA ACTIVITY AT SELECTED GAGING STATIONS, WATER YEAR 1960-61,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-02054

DETERMINATION OF TRACES OF SILVER IN WATERS BY ANION EXCHANGE AND

ATOMIC ABSORPTION SPECTROPHOTOMETRY,
Geological Survey, Denver, Colo.
T. T. Chao, M. J. Fishman, and J. W. Ball.
Anal Chim Acta, Vol 47, p 189-195, 1969. 7 p, 4 fig, 1 tab, 11 ref.

Descriptors: *Water analysis, *Trace elements, *Analytical techniques, *Spectrophotometry, *Anion exchange, Water chemistry, Ion exchange, Chelation.
Identifiers: *Silver, Ammonium pyrrolidine dithiocarbonate.

A method is described for the accurate determination of 0.1-1 microgram of silver per liter of water. The method permits stabilization of silver in water without loss to container walls. Optimum conditions have been established for the complete recovery of silver from water with an anion-exchange column, for quantitative elution of silver from the resin, and for measurement of silver by atomic absorption spectrophotometry after chelation with ammonium pyrrolidine dithiocarbamate and extraction of the chelate with MIBK. Silver in the 1-10 microgram/l range can be determined by extraction without pre-concentration on an ion-exchange resin. (Carstea-USGS)
W70-02099

ION-SELECTIVE ELECTRODES -- THEORY AND APPLICATIONS IN WATER ANALYSIS,
Pittsburgh Univ., Pa. Graduate School of Public Health.
For primary bibliographic entry see Field 05A.
W70-02112

THE APPLICATION OF SOME FUNDAMENTAL CHEMICAL EQUILIBRIUM CONCEPTS TO WATER SYSTEMS,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
Robert K. Ham.
Water and Sewage Works, Vol 116, 1969 Ref No, p R90-R104, Nov 28, 1969. 15 p, 4 fig, 2 ref.

Descriptors: *Water chemistry, *Aqueous solutions, *Solubility, *Reviews, Water treatment, Water analysis, Equilibrium, Hydrogen ion concentration, Corrosion, Stability, Chemical precipitation, Saturation, Ions, Scaling, Chemical potential, Chemical reactions, Mineralogy.
Identifiers: Chemical equilibrium.

Frequently people working in the areas of water and wastewater treatment, who are not chemistry oriented, need a concise, reasoned, yet fundamental development of the chemical concepts which would be useful to them. A special effort is made to answer part of this request by providing a means for understanding the general use of chemical equilibria considerations. Starting with basic definitions and chemical concepts, the reasons for and the means of construction of log c-pH diagrams are presented. Some uses of the diagrams are indicated by calculating the pH of a pure solution; determining the concentrations of the various species in a solution in which the pH is externally set; and by describing the changes and their implications which occur during an alkalinity titration. Finally, the concept of solubility is introduced, and the use of most of the material presented throughout the paper is illustrated by a fairly complex precipitation problem. (Knapp-USGS)
W70-02292

DEGREE OF SATURATION WITH RESPECT TO CALCITE, DOLOMITE, AND GYPSUM FOR SOME THERMAL AND MINERAL SPRINGS IN THE SOUTHERN ROCKY MOUNTAINS, ALBERTA AND BRITISH COLUMBIA,
Department of Energy, Mines and Resources, Calgary (Alberta). Inland Waters Branch.
R. O. Van Everdingen.
Canadian J Earth Sci, Vol 6, No 6, p 1421-1430, Dec 1969. 10 p, 1 fig, 4 tab, 9 ref.

Descriptors: *Water chemistry, *Springs, *Spring waters, Thermal springs, Cold springs, Mineral water, Calcite, Dolomite, Gypsum, Carbonates, Sulfates, Mineralogy, Calcium carbonate, Calcium sulfate, Aqueous solutions, Solubility.
Identifiers: *Canada, Alberta, British Columbia.

Comparison of ion-activity products and equilibrium constants for solution of calcite, dolomite, and gypsum indicates that water from Fairmont Hot Springs and Banff Hot Springs, and from thermal springs in British Columbia, on Lussier River, Ram Creek and near Fording Mountain, are supersaturated with respect to calcite and, to a lesser extent, with respect to dolomite. At other springs saturation occurs after water is discharged from the springs. In the case of hot springs this is caused by the rise in pH that accompanies loss of excess carbon dioxide and, to a lesser degree, by evaporation; cooling of the water tends to lower the degree of saturation somewhat. At cold springs, increase in water temperature after discharge increases the degree of saturation. Only near-saturation with respect to gypsum is indicated for Miette Hot Springs, Fairmont Hot Springs, and Fording Mountain Springs; precipitation of gypsum may occur here owing to evaporation of part of the water; the effect of temperature on the degree of saturation is small. (Knapp-USGS)
W70-02301

MID-ATLANTIC RIDGE NEAR 45 DEGREE N. IV. WATER PROPERTIES IN THE MEDIAN VALLEY,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
D. M. Garner, and W. L. Ford.
Canadian J Earth Sci, Vol 6, No 6, p 1359-1363, Dec 1969. 5 p, 3 fig, 11 ref.

Descriptors: *Water chemistry, *Water temperature, *Sea water, *Atlantic Ocean, Oceanography, Dissolved oxygen, Currents (Water), Ocean currents, Water properties, Sampling, Water analysis.
Identifiers: *Mid-Atlantic Ridge.

Water was sampled during August and September 1968, in six basins in the floor of the Median Valley of the Mid-Atlantic Ridge near latitude 45 deg N, and in the open Atlantic each side of the Ridge. Measurements were made of temperature, salinity, dissolved oxygen, reactive silica, and dissolved fluoride. Water properties in the valley are practically homogeneous below a depth of about 2390 m, and are controlled by the depths of saddles in the adjacent ridge systems. No thermal or chemical anomalies were found in waters within the basins which might have been due to geothermal action in the valley floor. Relatively high concentrations of dissolved oxygen in basin waters suggest that the valley is efficiently flushed. (Knapp-USGS)
W70-02302

GEOCHEMICAL INVESTIGATION OF THE GROUNDWATER SYSTEM IN THE LANSING, MICHIGAN, AREA,
Michigan State Univ., East Lansing. Dept. of Geology.
Samuel B. Romberger.
Mich State Univ Proj Terminal Rep to Office Water Resources Res, July 1969. 29 p, 2 tab. OWRR Proj No B-007-MICH.

Descriptors: *Water chemistry, *Groundwater, *Michigan, Aquifers, Glacial drift, Clay minerals, Ion exchange, Filtration, Aqueous solutions, Groundwater movement, Geochemistry, Data collections, Hydrologic data.
Identifiers: *Lansing (Mich).

The factors controlling the chemistry of groundwater in the upper Grand River drainage basin in Central Michigan were studied. The major aquifer is the Saginaw Formation, of Pennsylvanian age, consisting of sandstone and shale with minor limestone and coal. The overlying glacial material acts as a minor aquifer. Representative subsurface water samples were analysed for the major constituents; a representative composition would be: 330 ppm total hardness; 4 ppm Na, 1 ppm K; 84 ppm Ca; 26 ppm Mg; 1 ppm Fe; 3 ppm C; 25 ppm sulfate; 300 ppm bicarbonate; pH 7.5. No lateral or vertical zoning of chemical constituents was observed. The chemical nature of the groundwater depended on the aquifer and its clay content. This relationship is attributed to an ion filtration process and base exchange reactions. Quantitative thermodynamic considerations of the data suggest the groundwater in the Saginaw is close to saturation with respect to the carbonates calcite and dolomite, but undersaturated with respect to gypsum. All dissolved materials determined appear to originate in the soils and glacial material. (Knapp-USGS)
W70-02328

GEOLOGY AND GEOCHEMISTRY OF REEFS, CARBONATE SEDIMENTS, AND WATERS, GULF OF AQABA (ELAT), RED SEA,
Rensselaer Polytechnic Inst., Troy, N.Y.
For primary bibliographic entry see Field 02L.
W70-02337

PALEOCLIMATOLOGY AND THE RELATIVE STABILITY OF FELDSPAR MINERALS UNDER ATMOSPHERIC CONDITIONS,
California Univ., Davis. Dept. of Geology; and California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 02J.
W70-02339

DYNAMICS OF SALINITY AND CATION EXCHANGE EQUILIBRIA IN SOME IRAQI SOILS,
Agricultural Radioisotope Lab. (Iraq); and Alexandria Univ. (Egypt).
For primary bibliographic entry see Field 02G.
W70-02430

2L. Estuaries

BEACH LAMINATION: NATURE AND ORIGIN,
Geological Survey, Menlo Park, Calif.
H. Edward Clifton.
Marine Geol, Vol 7, No 6, p 553-559, Dec 1969. 7 p, 3 fig, 14 ref.

Descriptors: *Sedimentation, *Beaches, *Waves (Water), *Sedimentary structures, Deposition (Sediments), Sediment transport, Sands, Mineralogy, Beach erosion.
Identifiers: *Beach laminations.

A distinctive two-fold sedimentation unit characterizes lamination in the upper swash zone of beaches. Within the unit a fine or a heavy mineral rich layer at the base grades upward into a coarser or a heavy mineral poor layer at the top. This distinctive type of lamination results from grain segregation within bed flow during wave backwash. In plan the sedimentation units formed by wave backwash take the form of irregular ellipses elongate parallel to the strand line. Two units, which were untruncated by younger layers and thus appeared to be complete, were mapped to establish their lateral distribution. One occurred in an ellipse 21 ft long by 10 ft wide; the other was larger (64 ft long by 34 ft wide) and more irregular. The size and shape of the units in plan probably depend on topography and wave size. The backwash bed flow process and resulting graded two-fold sedimentation unit should occur on all beaches where lamination is produced on the upper foreshore. The distinctive stratification should also be present in ancient beaches, providing a useful means for identifying such paleogeographically important deposits. (Knapp-USGS)
W70-02057

MEASUREMENT OF WATER FLOW AND SUSPENDED-SEDIMENT LOAD, BOLINAS LAGOON, BOLINAS, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
John R. Ritter.
Geol Surv Res 1969, Prof Pap 650-B, p B189-B193, 1969. 5 p, 6 fig.

Descriptors: *Bays, *California, *Tides, *Currents (Water), *Suspended load, Surveys, Sedimentation, Deposition (Sediments), Streamflow, Sediment transport, Sands, Silts, Clays, Discharge (Water), Flow measurement.
Identifiers: Bolinas Lagoon (Calif).

Measurement of water flow and sediment load at the lagoon inlet for a 10-hour tidal period (floodtide and ebbtide) on June 22, 1967, revealed that in that specific period of time 152 tons of suspended sediment were carried into the lagoon by the floodtide, whereas only 36 tons were carried out of the lagoon by the ebbtide. However, the major ebbtide which was not measured probably carried the largest load of the day. Bedload made up as much as 18% of the total load during floodtide and 15% during ebbtide. Ten water measurements and seven sediment measurements were made during the floodtide (lower low water to lower high water). Six water measurements and five sediment measurements were made during the ebbtide (lower high water to higher low water). One measurement each of water and sediment was made during the second floodtide. The maximum measured water flow and maximum average velocity during floodtide were 5,810 cubic feet per second and 3.5 feet per second, respectively; during ebbtide the maximums were 3,720 cfs and 2.4 fps. The range of floodtide was about 4 ft, and ebbtide about 1.3 ft. Higher temperatures of water at the inlet possibly indicated lagoon water and ebbtide, and lower ones, ocean water and floodtide. (Knapp-USGS)
W70-02082

SALT-WATER ENCROACHMENT IN AQUIFERS OF THE BATON ROUGE AREA, LOUISIANA,
Geological Survey, Baton Rouge, La.
J. R. Rollo.
Louisiana Dept Conserv, Geol Surv, and Dept Public Works Water Resources Bull No 13, Aug 1969. 45 p, 4 fig, 6 plate, 1 tab, 9 ref.

Descriptors: *Saline water intrusion, *Aquifers, *Louisiana, *Surveys, Water quality, Hydrogeology, Data collections, Hydrologic data, Water levels, Groundwater movement, Coastal plains.
Identifiers: Baton Rouge (La).

Test wells drilled in the Baton Rouge area have defined large-scale faulting that cuts across the southern part of the area and acts as a hydraulic barrier to the northward movement of salty water. Salty water has been found in several aquifers north of the fault, but there is reasonable doubt that a significant quantity of salty water has moved or can move across the fault, except in the '400-foot' sands. The logical approach to any intrusion problem that can be envisioned should be one of cautious watchfulness. Until the salt-water fronts actually reach points of withdrawal, their flow paths from their known positions to the points of withdrawal are only generally predictable. When the salty water actually arrives, a method of control can be instituted with the certainty that the geographical location is correct and the benefits of control can be measured. (Knapp-USGS)
W70-02094

POSITION OF REGIONAL CARBONATE/NON-CARBONATE BOUNDARY IN NEARSHORE SEDIMENTS ALONG A COAST: POSSIBLE CLIMATIC INDICATOR,
Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.; and Rensselaer Polytechnic Inst., Troy, N.Y. Dept of Geology.
John E. Sanders, and Gerald M. Friedman.
Geol Soc Amer Bull, Vol 80, No 9, p 1789-1795, Sept 1969. 7 p, 1 fig, 50 ref.

Descriptors: *Paleoclimatology, *Quaternary period, *Sea level, *Water temperature, *Carbonates, Sedimentation, Sands, Glaciation, Water level fluctuations.
Identifiers: Paleoclimatic indicators, Lithologic boundaries.

In Holocene sediments along the Atlantic coast of eastern United States, the regional carbonate/noncarbonate boundary is located south of Miami, Florida. Study of the post-Cretaceous strata underlying the coastal plain and continental shelf indicates that this boundary has not remained fixed, but has shifted, presumably in response to changes of climate. Its movement to successively southward positions coincided with the times of cooling climate indicated by paleobotanical, paleobiological, and geochemical evidence. Position of the boundary enables comparison of Quaternary and pre-Quaternary climates. If the warmest Quaternary climates coincided with highest Quaternary sea levels, the northernmost position of the boundary should be recorded in the highest emerged marginal marine deposits of Quaternary age on the Atlantic Coastal Plain. Field evidence does not substantiate this prediction. In emerged Quaternary 'terraces' the northernmost boundary is located at about 27 deg N. lat, near its position during Late Cretaceous time. This suggests that during times of maximum Quaternary submergence the climate was only slightly warmer than it is today. If the northernmost position of the boundary is a reliable indicator of the time of maximum Quaternary warmth, then at least one time of great Quaternary warmth coincided not with a high sea level, but with a time of low sea level. (Knapp-USGS)
W70-02098

WATER QUALITY IN THE DELAWARE ESTUARY FOR TWO YEARS OF DROUGHT: 1965 AND 1966 FROM TRENTON, NEW JERSEY TO REEDY ISLAND, DELAWARE,
Geological Survey, Washington, D.C.
Walter B. Keighton.
Geol Surv Hydrol Invest Atlas HA-335, 2 sheet, 1969. 7 fig, 33 map, 1 tab, 6 ref.

Descriptors: *Water quality, *Delaware River, *Estuaries, *Droughts, Streamflow, Salinity, Dissolved oxygen, Path of pollutants, Water temperature, Solutes, Low flow.
Identifiers: Delaware River Estuary.

The effects of the 1961-1966 drought on the quality of water in the Delaware Estuary from Trenton, N.J. to Reedy Island, Delaware are discussed in a 2-sheet Hydrological Atlas consisting of text, maps, graphs, and tabulated data. During the last 2 years (1965-66) OF AN EXTENSIVE DROUGHT, SALINITY ADVANCED FARTHER UPSTREAM IN THE Delaware estuary than had been recorded previously. The farthest advance was in late summer and autumn when fresh-water flows into the estuary were lowest; salinity receded in late winter and early spring when snowmelt resulted in increased streamflow. The salinity at several locations in the estuary may be predicted from the discharge of fresh water at Trenton, if the discharge is steady. Fluctuations in discharge, or winds at the mouth of the estuary, often cause variations in the salinity. Dissolved-oxygen concentrations in the estuary are also seasonal. As early as May (1965-66) a considerable reach of the estuary had a dissolved-oxygen concentration of less than 1 mg/l, but by November the dissolved-oxygen concentration had recovered. The dissolved-oxygen deficit is related to the water temperature. In the summer river water is warm, the pollutants are oxidized more rapidly, and thus consume dissolved oxygen faster. (Knapp-USGS)
W70-02119

CALCULATION OF ALONG-THE-SHORE TRANSPORT OF SEDIMENTS IN ESTIMATING SHORELINE CHANGES OF RESERVOIRS (RUSSIAN),
Volga River Hydrometeorological Observatory.
N. A. Yaroslavtsev.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii, No 7, p 127-141, 1967. 15 p, 6 fig, 1 tab, 10 ref.

Descriptors: *Sediment transport, *Mathematical studies, *Shores, *Reservoirs, Sediment distribution, Waves (Water), Geology, Energy budget, Clays, Sands, Barriers, Dams.
Identifiers: *USSR, Kuibyshev Reservoir, Gorki Reservoir, Rybinsk Reservoir.

Wave energy equations and formulas were used to calculate sediment transport along reservoir shorelines, using data recorded at the Gorki, Kuibyshev, and Rybinsk Reservoirs of Central European USSR. The effects of sediment accumulation on erosional rock volume with or without natural and artificial barriers and the effects of wave energy on accumulation coefficients were analyzed and shown in curves and tables. In general the method can be applied only to shorelines consisting of poorly-consolidated sediments; however, it can be applied to some extent to the analysis of sediment transport along shorelines consisting of a complex of well indurated and poorly-consolidated rocks. (Gabriel-USGS)
W70-02230

ALGAL GROWTH AND SEWAGE EFFLUENT IN THE POTOMAC ESTUARY,
Johns Hopkins Univ., Baltimore, Md. Dept. of Sanitary Engineering and Water Resources.
Joseph Shapiro, and Roberto Ribeiro.
Journal Water Pollution Control Federation, Vol 37, No 7, p 1034-1042, July 1965. 6 fig, 2 tab, 7 ref.

Descriptors: *Algae, *Sewage effluents, *Estuaries, Fresh water, Lakes, Silts, Phosphates, Nitrogen, Waste water (Pollution), Scenedesmus, Cyanophyta, Chlorophyta, Chlorophyll, Bacteria, Trace elements, Vitamins, Amino acids, Calcium, Ammonia, Nitrogen fixation, Iron compounds, Light penetration, Water pollution effects, Eutrophication.
Identifiers: *Algal growth, *Potomac River, Plectonema, Nostoc paludosum, Bleaching, Washington (DC).

Addition of effluents from secondary wastewater treatment plants to Potomac River greatly increases growth of both green (chlorophytes) and blue-green algae (cyanophytes) in proportion to the quantity of effluent added. As little as 5% effluent is effective, and 40% is not supraoptimal. Since cyanophytes are able to provide their own nitrogen supply through fixation of molecular nitrogen, phosphate is the sole nutrient responsible for limiting their growth. Chlorophytes require both phosphate and ammonium-nitrogen for growth. Removal of ammonia from effluents will control chlorophytes only, but phosphate removal will limit cyanophytes as well. Partial removal of phosphorus from effluents will control both algal groups to a degree commensurate with extent of removal. Normal phosphorus concentrations of the Potomac River are such that increases in these concentrations will stimulate further algal growth. The hypothesis that trace substances are not limiting was verified. Silt, affecting light penetration and adsorption of phosphates or ammonia onto silt particles may both lead to reduced algal growths. Solution of the silt problem, through building of dams, must be tied to programs for nutrient control. (Jones-Wis)
W70-02255

CATALOG OF TSUNAMIS IN ALASKA,
Hawaii Univ., Honolulu; and Coast and Geodetic Survey, Honolulu, Hawaii.
Doak C. Cox, and George Pararas-Carayannis.
Rep for sale from US Dept of Commerce, Environmental Sci Services Admin, Coast and Geodetic

Survey. World Data Center A Rep WDCA-T 69-1, May 1969. 39 p, 1 tab, 88 ref.

Descriptors: *Tsunamis, *Alaska, *Data collections, *Bibliographies, Ocean waves, Waves (Water), Earthquakes, Landslides, Pacific Ocean.
Identifiers: World Data Center.

All available data pertaining to tsunamis in Alaska are summarized and the well-studied tsunami of 1964 is described briefly. An extensive bibliography of this and other recorded events is included. The times elapsing between the earthquakes with which Alaskan tsunamis are associated and the sweeping of the shores by the first tsunami waves are so short that the determination of significant potential tsunami hazard must be made much more rapidly than in the Tsunami Warning System that serves the Pacific as a whole and is centered at Honolulu. Indeed, the determination must be made, in many cases, prior to the collection and analysis of mareographic data which; is the main basis for analysis to tsunami hazard in the Pacific System. The Alaska system relies primarily on rapid analysis of seismic data telemetered to its operating center at Palmer and secondarily on mareographic data similarly telemetered. For older tsunamis, this report contains essentially all of the information available and considerable discussion as to the reliability of such data. (Knapp-USGS)
W70-02289

THE SEASONAL RANGE OF SEA TEMPERATURE ON THE NEW ZEALAND SHELF,
New Zealand Oceanographic Inst., Wellington. Dept. of Scientific and Industrial Research.
D. M. Garner.
New Zeal J Marine and Freshwater Res, Vol 3, No 2, p 201-208, June 1969. 8 p, 5 fig, 4 ref.

Descriptors: *Water temperature, *Seasonal, *Sea water, *Seashores, *Estuaries, Mapping, Gaging stations, Sampling, Salinity, Winter, Summer, Turbulence, Stratification, Thermocline.
Identifiers: *New Zealand.

Temperature-depth and surface salinity measurements of ocean water over the shelf around New Zealand were made in February and August-September 1967. The in-shore ends of the Subtropical Convergence are present off Castlepoint in the east and off Hokitika in the west. North of this boundary a fairly strong summer thermocline was identified. To the south of the convergence, vertical temperature stratification is weak, with a bottom temperature of 12 deg C. Surface salinity ranges from about 35.5 parts per thousand in the north to about 34.8 in the south. Extensive areas of lower salinity caused by drainage off the land are found off Fiordland, and the cold winter water east of South Island has salinities between 34.0 and 34.5 parts per thousand, indicating the intrusion of Subantarctic water. (Gabriel-USGS)
W70-02300

A FLORIDA SABELLARIIDAE REEF AND ITS EFFECT ON SEDIMENT DISTRIBUTION,
Florida State Univ., Tallahassee. Dept. of Oceanography.
Ralph Gram.
J Sediment Petrol, Vol 38, No 3, p 863-868, Sept 1968. 6 p, 3 fig, 3 tab, 4 ref.

Descriptors: *Sedimentation, *Sediment distribution, *Florida, *Reefs, Bottom sediments, Mapping, Mineralogy, Worms, Waves (Water), Analytical techniques, Carbonates, Sampling, Stokes law, Velocity, Mathematical studies, Biological properties.
Identifiers: Seminole Shores (Fla), Sabellariidae reefs, Chlorite.

Heavy minerals and size distribution of bottom sediments and reef materials have been examined in a Sabellariidae reef at Seminole Shores, Florida, approximately 100 miles northeast of Miami. Heavy mineral and shell fragment percentages in the reef material are up to ten times greater than in the adjacent bottom sediment. This distribution results from the tendency of the worm Phragmatopoma lapidosa to utilize the finer mineral grain sizes and platy shell fragments in tube construction. Accordingly, these worms improve the sorting of the beach sediments to a significant degree. (Gabriel-USGS)
W70-02334

GEOLOGY AND GEOCHEMISTRY OF REEFS, CARBONATE SEDIMENTS, AND WATERS, GULF OF AQABA (ELAT), RED SEA,
Rensselaer Polytechnic Inst., Troy, N.Y.
Gerald M. Friedman.
J Sediment Petrol, Vol 38, No 3, p 895-919, Sept 1968. 25 p, 32 fig, 5 tab, 86 ref.

Descriptors: *Geochemistry, *Geology, *Reefs, *Carbonate rocks, *Water chemistry, *Estuaries, Sea water, Climates, Continental Shelf, Coral, Algae, Lagoons, Mollusks, Mapping, Tertiary period, Salinity, Chlorides, Sulfates, Magnesium, Sodium, Potassium, Sampling, Faults (Geology), Iron, Copper, Uranium radioisotopes, Carbon.
Identifiers: *Gulf of Aqaba, *Red Sea.

The Gulf of Aqaba, a slightly hypersaline body of water, occupies a tectonic valley about 10 to 26 km wide. Its climate is hot and dry with the evaporation exceeding rainfall by 157 mm per year. Numerous reefs line the shelf (1/4 to 2 km wide), with coralline algae dominating the reefs environments, and sedimentary deposits and organisms forming a series of zones which vary as depth changes. The mineral composition of the reef-builders and reef-derived carbonate sediments is identical with that of other areas, such as Bermuda, the Bahamas, and Florida. Molluscan shells of the area are composed of low-magnesium aragonite and skeletons of corals of high-magnesium aragonite. Approximately linear relationships exist between barium and magnesium, barium and manganese, magnesium and manganese, iron and manganese, and iron and barium for coral, coralline algal, and molluscan skeletons and carbonate sands derived from them. (Gabriel-USGS)
W70-02337

MINERALOGY OF THE SAND SIZE CARBONATE FRACTION OF SOME RECENT MARINE TERRIGENOUS AND CARBONATE SEDIMENTS,
Duke Univ., Durham, N.C. Dept. of Geology; and Duke Univ., Beaufort, N.C. Marine Lab.
Orrin H. Pilkey, and Blake W. Blackwelder.
J Sediment Petrol, Vol 38, No 3, p 799-810, Sept 1968. 12 p, 12 fig, 23 ref.

Descriptors: *Sedimentation, *Sedimentary rocks, *Marine geology, *Carbonates, Mineralogy, Sands, X-ray diffraction, Mapping, Sampling, Continental Shelf, Magnesium, Calcite, Atlantic Ocean, Gulf of Mexico.
Identifiers: *Recent carbonate sediments.

A wide variety of sediments were examined in order to determine the factors controlling modern carbonate mineral distributions, that is of aragonite, calcite and Mg-calcite. The study was based on the X-ray diffraction analysis of 260 samples taken from the Atlantic Ocean and the Gulf of Mexico. The sand-sized fraction was utilized exclusively to insure making reliable identification of components. Aragonite and Mg-calcite are the most common minerals. The shelf of the Gulf of Mexico exhibits a more variable mineralogical content than the Atlantic shelf. Carbonate mineralogy exhibits a steady increase in low Mg-calcite with depth. No clear indication of the relative stability of aragonite and high Mg-calcite at great depths and no clearly-defined relationship between latitude and carbonate mineralogy were observed. (Gabriel-USGS)
W70-02338

RECENT SEDIMENTS AND DIAGENESIS OF SOUTH BONAIRE, NETHERLANDS ANTILLES,
Shell Oil Co., Midland, Tex.
F. J. Lucia.
J Sediment Petrol, Vol 38, No 3, p 845-858, Sept 1968. 14 p, 23 fig, 8 ref.

Descriptors: *Sedimentary rocks, *Sedimentation, *Diagenesis, Geology, Carbonates, Clays, Sands, Muds, Gypsum, Anhydrite, Dolomite, Mapping, Tertiary period, Recent epoch, Gastropids, Igneous rocks, Algae, Core drilling.
Identifiers: *Netherlands Antilles, *South Bonaire.

The general sedimentation and diagenetic history of South Bonaire (north of the coast of Venezuela) was analyzed on the basis of geological, paleontological, and petrographic data. The recent sediments are filling a depression in the Pleistocene surface of the island and the following sequence of deposition can be postulated: (a) deposition of a 'Halimeda' grainstone; (b) deposition of a lithoclastic sediment with clay beds and cementation of this sediment to form a carbonate crust; (c) deposition of an intertidal pelleted lime mud; and (d) bedded gypsum deposition and dolomitization of the pelleted lime mud. Textural similarity of Recent gypsum and anhydrite, and subsurface anhydrite leads to a supposition that subsurface anhydrite represents anhydrite formed near the surface, or anhydrite replacing gypsum formed near the surface. (Gabriel-USGS)
W70-02340

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SUL-BISUL ION EXCHANGE PROCESS: FIELD EVALUATION ON BRACKISH WATERS,
Elgin International Inc., Ill.
K. Schmidt, D. Senger, Dean Schwark, and H. Dalaly.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 -- Price $2.75. Office of Saline Water Research and Development Progress Report No 446, May 1969. 139 p, 28 fig, 17 tab, 2 photo. OSW Contract No 14-01-0001-1487.

Descriptors: *Desalination processes, *Ion exchange, Resins, Anion exchange, Cation exchange, Water chemistry, Brackish water, Desalting plants, Mineral water, Sulfates, Alkalinity.
Identifiers: *Webster Sul-bi Sul desalting, Sul-bi Sul anion resin.

Data of anion resin performance were obtained through experimental studies for use in prediction of anion resin capacity and raw water requirements for rinse regeneration. Cation resin performance characteristics with brackish water supplies are not yet totally predictable. Cation resin performance characteristics are more dependent on the total mineral content of the supply and less dependent on the actual chemical composition. Modifications of existing ion exchange technology are necessary. The advantageous features of the Webster Sul-bi Sul desalting plant are listed. The Sul-bi Sul process can economically treat high mineral waters within the limitations of its operating range. High alkalinity and high sulfate content are essential for Sul-bi Sul anion resin performance utilizing the rinse regeneration technique. (Carstea-USGS)
W70-02047

STUDY OF REJECTION OF VARIOUS SOLUTES BY REVERSE OSMOSIS MEMBRANES,
Gulf General Atomic, Inc., San Diego, Calif.
H. K. Lonsdale, C. E. Milstead, B. P. Cross, and F. M. Graber.

Available from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 -- Price $1.25. Office of Saline Water Research and Development Progress Report No 447, July 1969. 115 p, 12 fig, 18 tab, 53 ref, 9 append. OSW Contract No 14-01-0001-1717.

Descriptors: *Reverse osmosis, *Desalination processes, *Membranes, Solutes, Phosphates, Ammonia, Nitrates, Bicarbonates, Electrolytes, Salts, Phenols, Boron, Cellulose, Research and development, Pesticides, Water quality, Flow.
Identifiers: *Solutes rejection, Cellulose triacetate membrane, Reverse osmosis membranes.

Reverse osmosis membrane salt-rejection data were obtained for phosphate, ammonia, nitrate, and bicarbonate as well as other salts and nonelectrolytes that are important in water quality. The product water should have a low buffer strength because the rejection of bicarbonate is quite high. Reverse osmosis data showed that phenolic compounds will not be highly rejected. Thus, some of the pesticides and herbicides in some natural waters will not be removed by cellulose acetate membrane in reverse osmosis. Boron as boric acid was not highly rejected. Cellulose 2.5-acetate membranes appear to reject salts less effectively than cellulose triacetate membranes. The permeability of membranes is weakly dependent on salt concentration whereas the influence of solvent-solute flow is not of fundamental importance. (Carstea-USGS)
W70-02048

FIELD OPERATION OF A MOBILE REVERSE OSMOSIS PILOT PLANT,
Aerojet-General Corp., El Monte, Calif.
E. R. Watson.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 -- Price $1.00. Office Saline Water Research and Development Progress report No 429, May 1969. 61 p, 7 fig, 17 tab, 2 append. OSW Contract No 14-01-0001-1801.

Descriptors: *Desalination processes, *Desalination plants, *Reverse osmosis, *Pilot plants, Water quality, Calcium sulfate, Membranes, Ion, Manganese, Carbonates, Equipment, Scaling, Descaling.
Identifiers: *Mobile desalting plants.

Field operation of a 36-in. diameter pressure-vessel-type reverse osmosis system was studied over a seven month period. The quality of the product water was acceptable for the first five months of operation. Failure of adhesive-backed tape bonds used to splice two 20-in. sections of membrane was apparently responsible for the deterioration of the product water quality. Formation of calcium sulfate scale on the membrane surfaces limited the productivity. Removal of iron, manganese and carbonates by pretreatment procedures improved the production rates. It was concluded that the mechanical operation of the equipment was good. (Carstea-USGS)
W70-02050

BIOCIDAL RUBBER FOR WATER RECLAMATION SYSTEMS,
Goodrich (B. F.) Aerospace and Defense Products Co., Akron, Ohio.
C. J. Major, and Nathan F. Cardarelli.
Avail from Clearinghouse as AD-692 724, $3.00 in paper copy, $0.65 in microfiche. Aerospace Med Res Lab Rep AMRL-TR-69-17, Wright-Patterson AFB, Ohio, June 1969. 27 p, 3 fig, 16 tab. Air Force Contract No F33615-68-C-1266, Proj No 6373, Task No 637304, Work unit 007.

Descriptors: *Desalination, *Water reuse, *Bactericides, *Rubber, Distillation, Taste, Toxicity, Recirculated water, Reclaimed water.
Identifiers: Biocidal rubber compounds.

An assessment was made of the bactericidal efficacy of 17 biologically active elastomeric materials against 7 genera of microorganisms under static and varying dynamic conditions. A test cell and a laboratory model of a vacuum distillation water reclamation system used in the study are described. Compounds showing the greatest overall effectiveness in buffered distilled water solutions and in urine are delineated. Taste thresholds and data on rat feeding experiments using one of the biocidal agents are included. (Knapp-USGS)
W70-02059

A NEW DESIGN CONCEPT FOR REVERSE OSMOSIS MEMBRANE CELLS,
Aerojet-General Corp., El Monte, Calif.
G. A. Fluke.
Available from Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 -- Price $1.25. Office of Saline Water Research and Development Progress Report No 428, May 1969. 50 p, 6 tab, 24 fig, 1 append. OSW Contract No 14-01-0001-1329.

Descriptors: *Membranes, *Reverse osmosis, *Desalination processes, Costs, Cost analysis, Porous media, Sulfates, Chlorides, Sea water, Design, Permeability.
Identifiers: Membrane cells, Plate-and-frame reverse osmosis, Collection grooves.

Design concepts to reduce the cost of reverse osmosis devices were tested. Cost reduction in plate-and-frame reverse osmosis can be achieved by a lateral permeation of product water through a porous substrate. Materials that provide adequate permeation of product water parallel to a structural member plate eliminate the need for collection grooves. A high sulfate, low chloride retention membrane was used to test the concepts. In a synthetic sea water a 'blend' type high chloride retention membrane was used. The field replacement of membrane was successfully accomplished in a 'weeping cell' configuration apparatus. Externally mounted membranes with tubular supports were found to have the best configuration for porous substrate use. (Carstea-USGS)
W70-02063

EFFECTS OF POLYFLUOROCARBON COATINGS ON SCALING IN EVAPORATORS WITH CONTINUOUS FEED CALCIUM SULFATE SOLUTIONS,
Nebraska Univ., Lincoln. Dept. of Chemical Engineering.
Dennis D. Kos, and Luh C. Tao.
I and EC Prod Res and Develop, Vol 8, No 3, p 306-309, Sept 1969. 4 p, 2 fig, 1 tab, 10 ref. OWRR Project A-010-NEB.

Descriptors: *Desalination processes, *Distillation, *Coatings, *Boilers, *Scaling, Calcium sulfate, Descaling, Protective coatings, Films, Inhibitors, Linings, Plastics, Thin films.
Identifiers: Polyfluorocarbon scale-resistant tube coatings.

Experiments showed that coatings of polyfluorocarbon less than 0.001 inch thick on tube surfaces deterred scaling in evaporators with continuous feed of calcium sulfate solutions. Coated tube heat-transfer coefficients varied from 0.76 to 3.54 times those of uncoated tubes with the best results in the most concentrated solutions. Coatings appeared durable at the end of the longest (33 hr) run. Results are tabulated and shown graphically. (Knapp-USGS)
W70-02068

SALINE CONVERSION AND ICE STRUCTURES FROM ARTIFICIALLY GROWN SEA ICE,
Alaska Univ., College. Arctic Environmental Engineering Lab.; and Alaska Univ., College. Inst. of Water Resources.
H. R. Peyton, P. R. Johnson, and C. E. Behlke.
Univ Alaska Arctic Environ Eng Lab Res Rep No 4, Sept 1967. 30 p, 18 fig, 3 tab, 6 ref. OWRR Proj No B-001-ALAS.

Descriptors: *Desalination, *Construction materials, *Ice, *Freezing, *Sea water, Cold regions, Costs, Sea ice, Cryogenics, Crystal growth, Crystallization, Desalination processes, Construction.
Identifiers: Ice construction engineering.

In cold regions, desalination by freezing sea water was studied as a possible economical process. Power requirements are greatly lowered by using low winter temperatures to freeze water and using the summer's adequate solar energy to remelt it. The use of frozen sea water as a structural material was also studied. At high enough latitudes, summer ablation can be controlled to the point that major structures made of ice will last through the summer. Material costs should be low. (Knapp-USGS)
W70-02113

RECOVERY OF METAL SALTS FROM CONCENTRATED BRINES BY CHELATION,
Aerojet-General Corp., Sacramento, Calif.
David O. DePree, and Herman H. Weyland.
Available from Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 -- Price $0.60. Office of Saline Water Research and Development Progress Report No 435, 1969. 54 p, 8 tab, 16 fig. OSW Contract No 14-01-0001-1692.

Descriptors: *Chelation, *Brines, *Desalination processes, Metals, Salts, Evaportation, Resins, Cation exchange, Ion exchange, Potassium, Sodium, Magnesium, Calcium, Brackish water, Economics, Dissolved solids.
Identifiers: *Metal recovery, Methanol.

Separation of salts from concentrated brines by chelation processes can be conducted without the high energy input required by evaporation processes. Chelation is highly selective so that metal ions with economic value can be separared in relatively pure form. Regeneration of cation exchange resins with chelate solutions and separation of potassium, sodium, magnesium and calcium has been demonstrated. Concentration of metal chelate influences the recovery of metal salts by acidification of the chelate solutions. Desalination of brackish water containing 2000 ppm total dissolved solids was used to estimate the economics of an ion exchange desalination operation. These are several advantages of the regeneration process: (1) water-swollen resin has the highest rate of regeneration; (2) the most effective solvent and also the cheapest was methanol; (3) the polyvalent ions from the ion exchange resins are not removed by the chelating agents found effective in removing monovalent ions, and (4) Anhydrous HCL is used to precipitate metal salts from methanol solutions of the chelates. (Carstea-USGS)
W70-02116

DESALINATION RESEARCH AT OAK RIDGE,
Oak Ridge National Lab., Tenn.
K. A. Kraus, R. J. Raridon, J. S. Johnson, E. G. Bohlmann, and F. A. Posey.
Available from Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 -- Price $0.60. Office of Saline Water Research and Development Progress Report No 468, August 1969. 53 p, 95 ref. OSW Contract No 14-01-0001-937.

Descriptors: *Desalination, *Research and development, *Bibliographies, *Desalination processes, *Abstracts, Publications, Reviews, Surveys.
Identifiers: Oak Ridge National Laboratory, U.S. Atomic Energy Commission.

A bibliography and abstracts are presented of 95 open literature publications issued by the Oak Ridge National Laboratory, Water Research Pro-

gram from 1962 through December 1968. The Oak Ridge National Laboratory had been conducting a research program in desalination under an interagency agreement between the U.S. Department of the Interior and the U.S. Atomic Energy Commission. The acquisition of experimental data and the development of fundamental theory for a better understanding of desalination systems were the main objectives of the research program. The list of publications is arranged alphabetically by first author for each year and each publication includes the authors, title, literature reference and an abstract. Subject matter and author indices are also included. (Carstea-USGS)
W70-02117

EVAPORATION FOR DESALINATION,
Polytechnic Inst. of Brooklyn, N.Y.
Donald F. Othmer.
Desalination, Vol 6, No 1, p 13-24, Apr 1969. 12 p, 5 fig, 9 ref.

Descriptors: *Demineralization, *Desalination, *Evaporation, Brines, Vaporization, Pressure, Sea water, Fresh water, Costs, Capital costs, Investment, Heated water, Steam, Preheating, Heat transfer, Economies.
Identifiers: *Multistage flash distill, High temperature, Flash evaporation, Heat exchange, Heat sources, Cost savings.

Multistage flash (MSF) evaporation may produce 10 pounds of water per pound of steam, the so-called gain ratio. Several MSF units in a multi-effect series give twice this gain ratio at a large increase in plant cost. Variations in MSF increase the gain ratio substantially without increase, or with a decrease, of plant cost. First, the prime or brine heater, if used also as an evaporator to supply vapors to a half-stage above the No. 1 stage on the condensing-cooling side, may save 4 to 25% of required heat, depending on the number of stages. In large plants, this could produce many gallons more water per day without added heat cost or without increasing plant cost per unit of product. Second, the vapor reheat MSF system condenses vapors in direct contact with sprays of recycling fresh water in open flow, using no heat transfer surfaces, the largest cost item of an evaporator. Heat may be supplied by: (1) submerged combustion of a fluid fuel; (2) steam; (3) mechanical vapor compression; and (4) absorption-regeneration vapor compression. Over 50% saving of thermal or mechanical energy used may be possible by (3) and (4). Third, vapor reheat MSF may have the gain ratio increased 5 to 10% by changing the usual flows and heat reject from a lower stage. Conventional MSF may also benefit. (USBR)
W70-02158

WELLS PROVIDE SEA WATER - NATURALLY FILTERED.

Water and Sewage Works, Vol 116, 1969 Ref No, p R32-R34, Nov 28, 1969. 3 p, 3 fig, 5 ref.

Descriptors: *Water wells, *Beaches, *Sea water, *Induced infiltration, *Desalination plants, Water supply, Filtration, Permeability, Water yield, Groundwater movement, Transmissivity, Aquifers.
Identifiers: Sea water wells, Aquifer testing, Pumping tests.

Naturally filtered sea water in moderately large quantities for use as feed water for salt water conversion plants can be pumped from multiple-well systems installed in beach sand near or below high tide. The saturated beach sand constitutes a water-table aquifer that is replenished by the ocean. Wells are less likely to be damaged by storms than is an open-water intake structure. Where the thickness of beach sand is adequate, the cost of a well system will be less than that of a conventional intake, except for situations where unusually large quantities of sea water are needed. Static water levels and fluctuations of water levels prior to pumping tests must be measured and plotted for several tidal intervals, so that changes by the tide can be taken into account in calculating the hydraulic characteristics of the beach sand to obtain well yields. (Knapp-USGS)
W70-02290

DESIGN AND OPERATION OF LARGE DESALTING PLANTS,
Westinghouse Electric Corp., Pittsburgh, Pa. Heat Transfer Div.
Robert A. Baker, Jr.
Water and Sewage Works, Vol 116, 1969 Ref No, p R4-R16, Nov 28, 1969. 13 p, 10 fig.

Descriptors: *Desalination, *Desalination processes, *Desalination plants, *Reviews, Distillation, Reverse osmosis, Costs, Economics, Economies of Scale.
Identifiers: Key West (Fla), Kuwait.

The present state of desalination technology and economics are briefly reviewed. The most commonly used technique is flash distillation. The Key West plant is the largest and most efficient of this type in operation. It uses only 68 btu per lb of output. Construction cost was $4,056,000, and fresh water costs 86 cents per thousand gallons to produce. Combining desalination with power production can lower costs below those of single-purpose plants in many cases. Other techniques reviewed are experimental reverse osmosis plants for desalination, tertiary treatment, and water reuse. (Knapp-USGS)
W70-02291

3B. Water Yield Improvement

WATER RESOURCES OF CLARK, CLEVELAND, AND DALLAS COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
Raymond O. Plebuch, and Marion S. Hines.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402. Geol Surv Water-Supply Pap 1879-A, p A1-A32, 1969. 32 p, 2 fig, 1 plate, 8 tab, 27 ref.

Descriptors: *Water resources, *Arkansas, *Groundwater, *Surface waters, Reservoirs, Streamflow, Water wells, Aquifers, Water quality, Water yield, Hydrologic data, Data collections, Water utilization, Hydrogeology, Water resources development.
Identifiers: *Clark County (Ark), Cleveland County (Ark), Dallas County (Ark).

Clark, Cleveland, and Dallas counties constitute an area of 2,151 square miles in south-central Arkansas. The area is drained by the Ouachita, Saline, and Little Missouri Rivers and their tributaries. The amount of water available for use can be increased by the construction of reservoirs. The average surface-water yield in the area is about 1/4 cubic feet per second per square mile, or a total of about 3,000 cfs. Generally, the water quality is good; but water from some of the streams, particularly from the smaller tributaries, may require treatment for excessive iron content and high color. The consolidated rocks in the Interior Highlands generally yield less than 10 gpm to wells, precluding the development of large municipal or industrial groundwater supplies in that area. The formations of Tertiary age offer the best possibilities for groundwater, particularly in Dallas and Cleveland Counties. The Sparta Sand is the best aquifer in the project area, particularly east of central Dallas County. Well yields of 700 gallons per minute or more are possible. The deposits of Quaternary age are thin and generally suitable only for domestic supplies. Total water use in the project area in 1965 was about 0.6 million gallons per day since 1960. Slightly more than one-half this amount was derived from surface-water sources. Total water use in the area in 1967 was insignificant compared with the total water available. (Knapp-USGS)
W70-02055

PRELIMINARY REPORT ON THE WATER RESOURCES ON THE LAHAINA DISTRICT, MAUI,
Geological Survey, Honolulu, Hawaii.
George Yamanaga, and C. J. Huxel.
Hawaii Div of Water and Land Develop Circ c51, Feb 1969. 47 p, 16 fig, 14 tab, 13 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Hawaii, Streamflow, Base flow, Aquifers, Water resources development, Water wells, Water levels, Water quality, Saline water intrusion, Water yield, Water storage.
Identifiers: Lahaina, Maui (Hawaii).

The Lahaina District, Hawaii consists of the western part of the West Maui volcanic dome. Numerous intersecting dikes in the central part of the dome, where rainfall is high, impound a large high-level groundwater body, oval-shaped in plan. All perennial streams in the Lahaina District derive their dry-weather flow (base flow) from this high-level water body. The aggregate low flow of streams in the District exceeds 25 mgd. Basal groundwater occurs in a peripheral belt surrounding the area of high-level water. Pumpage from the basal-water body averages about 50 mgd. The fresh-water lens is thin near the shore. Heavy concentrated pumping from wells and shafts, even as much as 3,000 ft inland, results in large, though usually temporary, increases in salinity. In general, fresher water is found farther inland, nearer the high-level water. Leakage of high-level water through confining boundary dikes is probably a major recharge source for the basal-water body. The high-level water body appears to be the most promising source that might be tapped if additional domestic water is needed. (Knapp-USGS)
W70-02065

GEOHYDROLOGY OF HENRY AND WEAKLEY COUNTIES, TENNESSEE,
Tennessee Dept. of Conservation, Nashville. Div. of Water Resources; and Geological Survey, Nashville, Tenn.
John M. Wilson, and James H. Criner.
Tenn Dep Conserv, Water Resources Div Rep, 1969. 49 p, 12 fig, 1 plate, 13 ref, 5 append.

Descriptors: *Hydrogeology, *Groundwater, *Water quality, *Tennessee, Water wells, Water yield, Water utilization, Groundwater movement, Water pollution sources, Water levels, Hydrologic data, Data collections, Aquifers, Water level fluctuations.
Identifiers: Henry County, Weakley County (Tenn).

The water-yielding potential and water quality of the shallow aquifers in Henry and Weakley Counties, Tennessee are discussed. Although the geologic character of the shallow aquifers is quite different from place to place, sufficient quantities of water for domestic and farm use are universally available. Supplies adequate for municipal and industrial use are also available in much of the area from one of the three major artesian aquifers. The use of groundwater in the area in 1967 is estimated at 5 mgd. Rural residents and farmers account for about one-third of the total. The rate of withdrawal could be increased a hundred percent without ill effects. The dissolved iron content of the shallow groundwater supplies is commonly troublesome, but this problem can be solved by corrective treatment to remove the excess iron prior to use. Except for the undesirable high dissolved iron content of some supplies, the chemical quality of the groundwater in the report area is excellent for most uses without treatment. Bacterial contamination was noted in most large diameter, concrete-cased wells. Unsafe well design and construction practices are considered to be the chief cause of this type of contamination. (Knapp-USGS)
W70-02071

DEVELOPMENT OF GROUNDWATER SUPPLIES ON THE PAJARITO PLATEAU, LOS ALAMOS COUNTY, NEW MEXICO,
Geological Survey, Santa Fe, N. Mex.; and Geological Survey, Albuquerque, N. Mex.
William D. Purtymun, and James B. Cooper.
Geol Surv Res 1969, Prof Pap 650-B, p B149-B153, 1969. 5 p, 2 fig, 3 tab, 4 ref.

Descriptors: *Water supply, *Groundwater, *Aquifers, *New Mexico, Water yield, Water wells, Hydrogeology, Permeability, Hydrologic data.
Identifiers: *Los Alamos (New Mexico).

The Pajarito Mesa well field, completed in 1966 on the Pajarito Plateau, contributed 37% of the total water supply to Los Alamos in 1967. Two wells in the field are capable of yields of 1,400 gallons per minute each. This yield is about three times that of any of the other 13 supply wells in the water-supply system. The high yield of the two wells is attributed to the occurrence of coarse volcanic debris and arkosic sediment in the Puye and Tesuque Formations of the Santa Fe Group that make up the main aquifer beneath the Pajarito Plateau. (Knapp-USGS)
W70-02076

OCCURRENCE AND MOVEMENT OF GROUNDWATER IN THE BRUNSWICK SHALE AT A SITE NEAR TRENTON, NEW JERSEY,
Geological Survey, Trenton, N.J.; and New Jersey State Dept. of Conservation and Economic Development. Water Policy and Supply Div.
John Vecchioli, Louis D. Carswell, and Haig F. Kasabach.
Geol Surv Res 1969, Prof Pap 650-B, p B154-B157, 1969. 4 p, 5 fig, 2 ref.

Descriptors: *Water wells, *Aquifers, *Groundwater movement, *New Jersey, Hydrogeology, Hydrologic data, Water yield, Permeability, Transmissivity.
Identifiers: *Trenton (NJ), Brunswick Shale.

Measurements of yield made during the drilling of 13 wells in the Brunswick Shale of Late Triassic age near Trenton, N. J., indicate that groundwater occurs mainly in discrete zones controlled by bedding. Productivity of a well may be dependent on only one or on several zones; however, no relation was apparent between yield and the number of zones penetrated. Movement of water under pumping conditions, and presumably under natural conditions, is preferentially along strike, as indicated by drawdown observations made during several pumping tests. Wells situated along strike and thus tapping common producing zones had a greater drawdown than wells equidistant in transverse directions. Knowledge of a preferential direction of water movement in the Brunswick Shale is invaluable when locating a well with respect to a potential source of pollution or in attempting to minimize well interference. (Knapp-USGS)
W70-02077

EFFECTS OF RESERVOIR FILLING ON A BURIED AQUIFER OF GLACIAL ORIGIN, CAMPBELL COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, S. Dak.
Neil C. Koch.
Geol Surv Res 1969, Prof Pap 650-B, p B169-B173, 1969. 5 p, 4 fig, 2 ref.

Descriptors: *Surface-groundwater relationships, *South Dakota, *Reservoir storage, *Aquifers, *Water levels, Recharge, Groundwater movement, Induced infiltration, Alluvium, Missouri River, Hydrographs.
Identifiers: *Oahe Reservoir (S Dak).

The filling of the Oahe Reservoir, which raised the reservoir surface west of Pollock, S. Dak., about 47 feet by December 1967, has produced a rise in the piezometric surface in a large buried artesian aquifer of glacial origin. The rise resulted in water-level rises of 34, 22, 20, and 17 feet in wells about 4, 11 1/2, 16 1/2, and 18 miles, respectively, from the reservoir. The piezometric surface 4 miles from the reservoir was about 13 feet above reservoir level as of December 1967. The aquifer is practically undeveloped. If development of the aquifer lowers the level of the piezometric surface below that of the reservoir surface, the hydraulic gradient would reverse and induce recharge from the Oahe Reservoir. This would provide a nearly unlimited water supply and would eventually improve the quality of water in the aquifer. (Knapp-USGS)
W70-02081

A STATISTICAL STUDY OF THE DEPTH OF PRECIPITABLE WATER IN WESTERN TEXAS AND EASTERN NEW MEXICO,
Texas A and M Univ., College Station.
Samuel Erick Baker.
Tex Water Develop Board Rep No 96, June 1969. 79 p, 4 fig, 7 tab, 21 ref, 3 append.

Descriptors: *Precipitable water, *Texas, *Meteorology, *Synoptic analysis, Statistical methods, Precipitation (Atmospheric), Cloud seeding, Arid lands, Weather modification.
Identifiers: West Texas, Eastern New Mexico.

Total depth of precipitable water for 5 stations in western Texas and eastern New Mexico is studied to determine a frequency distribution which will describe this climatic element. A conclusion evolving from the study is that a normal distribution adjusted for skewness and kurtosis may be used to describe adequately the frequency distribution presented by the observed depths of precipitable water grouped by pentads. An annual series of the yearly maximum depth of precipitable water from each of the 5 stations is plotted vs the recurrence interval. A Gumbel distribution is fitted to each annual series providing a means of determining the return periods of extreme depths of precipitable water. The probabilities of precipitable water depths are tabulated and shown by graphs. The data may be used to predict the potential yield from cloud seeding programs to increase regional water yield. (Knapp-USGS)
W70-02096

WATER USE BY SALTCEDAR WITH MANY FACTORS,
Geological Survey, Lubbock, Tex.
T. E. A. van Hylckama.
Pap, Geol Surv, Lubbock, Tex, Mar 1969. 22 p, 7 fig, 4 tab, 11 ref.

Descriptors: *Tamarisk, *Water utilization, *Phreatophytes, Electrical conductance, Arid lands, *Consumptive use, Evapotranspiration, Arizona, Salinity, Tanks (Containers), Evaporation, Transpiration, Soil moisture, Depth, Water table, Saline water, Plant growth.
Identifiers: Evapotranspirometers, Gila River (Ariz), Hydrophytes.

During 6 yr of observations on water use by saltcedar on the Gila River, Ariz., using evapotranspirometers (tanks), the following conclusions were reached: (1) the quantity of water used by evaporation or transpiration depends on depth to ground water in the tanks and on salinity of the soil moisture; (2) in 2 tanks the saltcedar was thinned out in the early spring to half its original density when 3 to 4 m high. In the tank with good-quality water, the water use dropped 30%, but within 2 mo was only 5% less than the water used in the control tank. In the other tank with more saline soil moisture, water use dropped 35% and after 2 mo was still 25% less than the water used in the control tank; (3) in 2 other tanks, the saltcedar in the early spring was cut to knee height. In the low-conductivity tank, the water use dropped 70%, but after 2 mo was only 30% less than the water used in the control tank. In the tank with saline water, water use dropped 90% and after 2 mo was still 60% less than the water used in the control tank; (4) under conditions of low salinity of soil moisture, saltcedar sprouts grow faster than when more saline conditions prevail. The difference in growth characteristics between control and thinned-out stands is not significant. (USBR)
W70-02134

RETAINING SURFACE RUNOFF ON AGRICULTURAL LANDS (RUSSIAN),
Ukrainskii Nauchno-Issledovatelskii Institut Lesnogo Khoziaistva i Agrolesomelioratsii, Kharkov (USSR).
For primary bibliographic entry see Field 02A.
W70-02228

WATER EVAPORATION SUPPRESSION,
Virginia Univ., Charlottesville.
John L. Gainer, James T. Beard, and Robert R. Thomas.
Available from the Clearinghouse as PB-188 498, $3.00 in paper copy, $0.65 in microfiche. Virginia Water Resources Research Center Bulletin 27, Aug 1969. 23 p, 3 tab, 6 fig, 13 ref. OWRR Project A-019-VA.

Descriptors: *Evaporation, *Diffusion, *Solar radiation, *Infrared radiation, *Monomolecular films, Mass transfer, Evaporation control, Water conservation, Water loss, Energy, Thin films, Films, Surfactants, Molecular diffusion, Diffusivity, Thermal pollution, Air water interface.
Identifiers: *Solar reflection, Reflection, Water reflection, Reflectance, Reflectivity.

A theory is presented which relates the diffusion of water through a liquid monolayer to the monolayer surface pressure. This enables quick evaluation of a monolayer's ability to retard evaporation. The evaporation process is driven by solar energy, which is absorbed at the water surface. Placing a reflecting film on the surface would be one method of evaporation suppression. As yellow materials reflect at wave lengths where solar energy has its peak intensity, yellow monolayers and dyed monolayers were studied experimentally. No materials were found to both form a stable monolayer and to significantly improve the reflectivity of the water surface. A yellow silicone oil film on a water surface was studied after it was found experimentally to reflect solar energy about 1.7 times better than a plain water surface. Although it sometimes does not form a monolayer, it did reduce evaporation by diffusion. When spread over a water surface, it reduced evaporation by a minimum 10%, and it reduced evaporation by a minimum 15% when spread over a lenoleic acid monolayer. In addition, the film was found to be extremely difficult to remove from a water surface. This is a real advantage when one considers the need to constantly resupply monolayers presently used in evaporation suppression applications.
W70-02276

INFLUENCE OF SOLAR RADIATION REFLECTANCE ON WATER EVAPORATION,
Virginia Univ., Charlottesville.
James T. Beard, and David K. Hollen.
Available from the Clearinghouse as PB-188 499, $3.00 in paper copy, $0.65 in microfiche. Virginia Water Resources Research Center Bulletin 30, Aug 1969. 26 p, 3 tab, 4 fig, 23 ref. OWRR Project A-019-VA.

Descriptors: *Evaporation, *Evaporation control, *Solar radiation, *Monomolecular films, *Water loss, *Thin films, *Energy budget, Energy, Heat transfer, Mass transfer, Air water interface, Water conservation, Infrared radiation, Water loss, Water, Reservoirs, Films, Surfactants, Thermal pollution, Temperature.
Identifiers: *Solar reflection, Reflection, Water reflection, Reflectance, Reflectivity.

Reservoir evaporation may be reduced by increasing the reflectance of solar energy by the water surface. Such a change in reflectance will require surface modifications such as application of a special

surface film or monolayer which has good reflecting properties. The amount of evaporation suppression will depend also on the changes in diffusion coefficient and shear stress which will accompany surface modifications. The transient energy equation was applied to an element of a water surface. Numerical methods were used to solve the equation with the aid of a digital computer. An evaluation of the various energy terms was required for this analysis. These terms included: convection heat transfer, absorbed solar energy, long-wave radiant energy, energy associated with evaporation, and the transient storage of energy. The analytical model gave an average evaporation suppression by cetyl alcohol to be 22.6%. This is consistent with the experimental work of Crow at Oklahoma State University, who indicated a 25% reduction. Results for monolayers with hypothetical reflectance properties and with the diffusion properties of a cetyl alcohol monolayer showed average evaporation reductions of 25% to 45%, depending on the reflection properties selected.
W70-02277

METHODS FOR EVALUATING THE EFFECTS OF UPSTREAM FLOOD CONTROL MEASURES ON WATERSHED YIELD,
Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W70-02322

3C. Use of Water of Impaired Quality

ECONOMIC EFFECTS OF USING SUBSTANDARD QUALITY WATER IN WEBSTER AND OTHER COMMUNITIES IN SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Economics.
Arthur J. Matson, Norman G. Giebink, and Louis C. Rentschler.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 -- Price $1.50. Office Saline Water Res and Develop Progr Rep No 463, Oct 1969. 191 p, 1 fig, 42 tab, 37 ref. OSW Grant No 14-01-0001-463.

Descriptors: *Water quality, *Municipal water, *Desalination, *South Dakota, Water costs, Economic impact, Fresh water, Brackish water, Pilot plants, Statistical methods, Research and development.
Identifiers: *Webster (S Dak), Northern Great Plains.

The municipal use of water before and after conversion of brackish water into fresh water was studied in several towns in NE South Dakota. The economical aspects of saline water conversion, water use, and water supply are discussed. A brackish water conversion demonstration plant supplied the Webster municipal system with water that could be taken as a standard for comparison. However, there was a lack of general agreement of what constituted good water. Statistical analysis was applied to identify uses of water in relation to water quality. Water quality was recognized as one factor in the total economic growth of this region in the Northern Great Plains. Additional research is recommended to establish relationships useful in decisions regarding investment in water quality improvement. (Carstea-USGS)
W70-02051

EFFECT OF IRRIGATION ON THE CHEMICAL QUALITY OF LOW STREAMFLOW ADJACENT TO CEDAR BLUFF IRRIGATION DISTRICT, KANSAS,
Geological Survey, Lawrence, Kans.
For primary bibliographic entry see Field 05C.
W70-02093

EFFECTS OF MARGINAL QUALITY IRRIGATION WATER ON THE ACCUMULATION OF SALTS AND ALKALI IN SOUTH DAKOTA SOILS,
South Dakota State Univ., Brookings.
John M. Madden.
Available from the Clearinghouse as PB-188 503, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Nov 1969. 55 p, 18 tab, 18 fig, 7 ref, 3 append. OWRR Project A-011-SDAK.

Descriptors: Irrigation engineering, *Saline soils, Soil chemical properties, Soil analysis, *Irrigation effects, Irrigation water, Soil physical properties.

The purpose of this research was to determine the effects of marginal quality irrigation water on the salt and alkali accumulation in soils peculiar to the sub-humid and semi-arid climate existing in South Dakota. Soil samples were taken from the fields of eleven cooperating farmers and analyzed to determine the exchangeable-sodium-percentage, SAR, electrical conductivity, pH, soluble carbonates, alkalinity, and saturation percentage. The irrigation waters were sampled and analyzed to determine the SAR, pH, electrical conductivity, residual sodium carbonate, and total soluble salts. The above samples were taken periodically for the duration of the project. Cropping practices, amounts of irrigation water applied, and rainfall were also recorded. The resulting data were analyzed to determine the amounts and rates of salt and alkali accumulation. Equations were also derived with the objective of estimating the exchangeable-sodium-percentage of the soil from determinations made on the saturation paste and its extract.
W70-02280

CRITERIA FOR THE EVALUATION OF THE DEGREE OF SOIL SALINITY FOR THE PURPOSE OF IRRIGATION (RUSSIAN),
V. M. Borovskiy.
Vestnik Akademii Nauk SSSR, No 9, p 85-90, Sept 1969. 3 tab, 5 ref.

Descriptors: *Soils, *Salinity, *Irrigation, *Irrigation water, Rivers, Climates, Geology, Mineralogy, Surface runoff, Groundwater, Topography, Solubility, Water balance, Deserts, Water levels.
Identifiers: *USSR, Kazakh SSR, Syr-Darya delta.

Salt content of the soils and groundwaters of the Amu Darya and Syr Darya River deltas was investigated by using detailed sampling. In all cases where a dynamic soil-groundwater intercommunication system is present, the groundwaters are characterized by greater salt contents than the soils. Salt-marsh areas are characterized by having no more than 6% salt content in soil and groundwater; however, in using groundwater for irrigation it should be noted that chlorides in groundwater are more toxic to plants than sulfate in soil water. (Gabriel-USGS)
W70-02418

THE PROSPECTS OF UTILIZATION OF THERMAL WATERS (THE MAKHACHKALA CONFERENCE) (RUSSIAN),
I. M. Dvorov.
Vestnik Adademii Nauk SSSR, No 9, p 127-129, Sept 1969.

Descriptors: *Thermal water, *Thermal power, *Water temperature, *Water utilization, *Conferences, Instrumentation, Electric powerplants, Energy budget, Agricultural engineering, Discharge (Water), Trace elements, Mining, Irrigation water.
Identifiers: *USSR.

A brief outline of the results of the geothermal conference on the 'Thermal Waters of the USSR and the Prospects of Their Utilization' is given. Large resources of thermal waters are present in Kamchatka, the Magadan region, the Transbaikal Lake area, and other areas of the USSR. Thermal waters of 40 to 70 deg C can be utilized for agricultural purposes. (Gabriel-USGS)
W70-02419

THE PROBLEM OF MAKING WASTE WATER SAFE AND ITS USE IN IRRIGATING LIGHT CHESTNUT SOILS IN THE POVOLZHYE AREA,
Volgograd Agricultural Inst. (USSR).
V. F. Shubin.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol I, p 405-413, 1968. 2 tab.

Descriptors: *Wastes, *Arid lands, *Irrigation practices, *Water reuse, *Water pollution treatment, Alkaline soils, Soil chemical properties, Water pollution sources, Irrigable land, Water utilization, Water conservation.
Identifiers: *USSR.

The author reports of experimental use of industrial and urban wastes to irrigate mildly alkaline soils in the semiarid lower Volga in the USSR. The waters used were those wastes not emitted from chemical industrial processes such as those from synthetic rubber plants. The author concludes that it is highly desirable to run pilot tests with the waste waters and soils of any given region to develop suitable irrigation practices before embarking on large scale irrigation projects. The waste waters were found useful for irrigation and fertilizing and these uses also helped purify the waters. Food, fiber, oil-producing, fruit and tobacco crops were successful. If the waste waters were free of toxic properties, it was found that they could be used if they were properly mixed with sewage and conditionally cleaned waters. No problem of contamination of rivers, lakes, ponds and other natural water resources was found. (Crouse-Arizona)
W70-02424

SOIL AND SALINITY FACTORS IN IRRIGATION AND DRAINAGE OF MALLEE LANDS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
For primary bibliographic entry see Field 02G.
W70-02425

THE SIGNIFICANCE OF THE EXTERNAL WATER POTENTIAL AND OF SALT TRANSPORT TO WATER RELATIONS IN PLANTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02G.
W70-02426

QUALITY OF IRRIGATION WATER,
Indian Council of Agricultural Research, New Delhi; and Punjab Agriculture University, Hissar (India).
J. S. Kanwar, and B. S. Kanwar.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol I, p 391-403, 1968. 5 tab, 1 fig, 24 ref.

Descriptors: *Water quality, *Irrigation water, Soil chemical properties, *Saline water, *Sodium, Crop response, Soil-water-plant relationships, Subsurface waters, Wheat, Germination, Groundwater, Corn (Field), Arid lands, Adsorption, Cation adsorption, Salts, Semiarid climates, Water chemistry.
Identifiers: *India.

When determining quality of water for irrigation, the nature and property of soils, crop to be grown and climate should be considered as well as chemical composition of the water. Although sub-soil waters in arid areas frequently contain substantial amounts of salts they are sometimes used successfully for irrigation when other conditions are suitable. The authors report a randomized block experiment using waters of 4 salinity levels and 4 SAR (sodium absorption ratios). Two crops of maize fodder and 1 of wheat were grown in succession. A total of 90 inches of irrigation water was applied for the three crops. Effects of different cation compositions in the irrigation water were also studied. Yields of all crops decreased as salt concentration in water increased. When the salt level was raised

to 200 m-equiv./litre, the second and third crops could not germinate. Increased SAR did not have so great an effect on yield. It was concluded that the nature of the soil and cumulative effect of a given amount of saline water on soil determines the effect on crops. The authors endorse use of triangular diagram methods considering soil, water and plant in determining water quality for a particular irrigation use. (Crouse-Arizona)
W70-02429

UTILIZATION OF SOIL MOISTURE AND GROUNDWATER BY COTTON PLANTS IN THE CASE OF SALINE GROUNDWATER,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 05G.
W70-02432

SALTING IN IRRIGATION AREAS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Soils.
For primary bibliographic entry see Field 02G.
W70-02433

SALINIZATION OF SOILS OF PIEDMONT PLAINS,
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
For primary bibliographic entry see Field 02G.
W70-02434

ATRIPLEX POLYCARPA: II. GERMINATION AND GROWTH IN WATER CULTURES CONTAINING HIGH LEVELS OF BORON,
California Univ., Riverside. Dept. of Agronomy; and California Univ., Riverside. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02I.
W70-02438

THE SALTING FACTORS OF IRRIGATED SOILS IN THE TURAN PLAIN,
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
For primary bibliographic entry see Field 02G.
W70-02439

EXPERIENCE IN ACCELERATED IRREVERSIBLE DESALINIZATION OF SOILS IN GOLODNAYA STEPPE,
All-Union Scientific-Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-02441

3D. Conservation in Domestic and Municipal Use

PRODUCTION AND UTILIZATION OF WATER IN THE METROPOLITAN AREA OF JACKSONVILLE, FLORIDA,
Geological Survey, Jacksonville, Fla.
G. W. Leve, and D. A. Goolsby.
Florida State Board of Conserv, Div of Geol Inform Circ No 58, 1969. 37 p, 9 fig, 14 tab, 6 ref.

Descriptors: *Water supply, *Water yield, *Water utilization, *Florida, Surface waters, Groundwater, Water wells, Aquifers, Water levels, Water quality, Hydrogeology, Date collections, Hydrologic data, Water yield, Municipal water, Industrial water, Urbanization.
Identifiers: Jacksonville (Fla).

Large quantities of water are available both from numerous surface streams and from underground aquifers in the Jacksonville, Florida area; however, the water in most of the surface streams is brackish at least part of the year and is used for limited industrial purposes. The potable water supplies in the area are obtained from 3 aquifers: surficial sand beds; limestone, shell and sand beds between 50 to 150 ft below the surface; and limestone and dolomite beds more than 300 to 600 ft below the surface and about 1,600 ft thick (the Floridan aquifer). The city of Jacksonville municipal water utility pumped an average of about 36 mgd in 1966 from 47 wells drilled into the Floridan aquifer. The municipal utilities of Jacksonville Beach, Neptune Beach, and Atlantic Beach pumped a total average of about 3 mgd in 1966 from 11 wells in the Floridan aquifer. Eighty-nine large, privately and corporately owned water utilities in the area produced a total average of about 22 mgd in 1966 from 105 wells in the Floridan aquifer. Two large naval bases produced a total average of about 5.5 mgd in 1966 from 8 wells in the Floridan aquifer. Private wells yielded an estimated 10 to 25 mgd from the limestone, shell and sand aquifer and about 5 mgd from the Floridan aquifer in 1966. The average water withdrawals by all of the municipal and privately and corporately owned water utilities in the area increased from 27 mgd in 1947 to 60 mgd in 1966. (Knapp-USGS)
W70-02092

TIME-CAPACITY EXPANSION OF URBAN WATER SYSTEMS,
Stanford Research Inst., Menlo Park, Calif.
For primary bibliographic entry see Field 06D.
W70-02267

3E. Conservation in Industry

ACQUISITION OF WATER FROM FEDERAL RECLAMATION PROJECTS FOR INDUSTRIAL AND COMMUNITY DEVELOPMENT,
Bureau of Reclamation, Washington, D.C.
Floyd E. Dominy.
Pap, 15th Annu Rocky Mt Miner Law Inst, Vail, Colo, July 1969. 43 p, 7 fig, 2 tab, 20 ref.

Descriptors: Natural resources, *Water supply, Water quality, Water resources, *Industrial water, *Municipal water, Irrigation water, Costs, Water consumption, Interest, Water resources development, Population, Multiple-purpose projects, Repayment contracts, Population growth, Water requirements, Legislation, Water delivery, Water demand, Bibliographies.
Identifiers: *Water supply forecasting, Repayment, Operation and maintenance costs.

Water is a vital prerequisite to progress because existing industries cannot expand and new industries cannot develop in areas lacking an adequate water supply. Federal Reclamation projects have been designed to help meet these needs and play an increasingly important role in supplying future needs. National philosophy has been that all Reclamation project costs for the purpose of irrigation, power, and municipal and industrial supply should be repaid in full. Repayment of all reimbursable project costs and operation and maintenance costs is a responsibility of project beneficiaries. Municipal and industrial water supply costs are repaid in 50 yr (with interest) by revenues from water users. Many western cities rely on water supplies developed or being developed by Reclamation, and demand is increasing with population expansion. Municipal and industrial water demands in the western water regions for a population of over 160 million by the yr 2020 are estimated to increase from 7.8 trillion gal. in 1965 to 62.1 trillion gal. in 2020. Future developments and the possibilities of tapping new sources such as weather modification make the physical potential promising for community and industrial development in connection with water supplies from Reclamation projects. (USBR)
W70-02167

3F. Conservation in Agriculture

EVAPORATION AND CONDENSATION ON BARE SOIL UNDER IRRIGATION IN THE EAST CENTRAL GREAT PLAINS,
Nebraska Univ., Lincoln.
Norman J. Rosenberg.
Agron J, Vol 61, No 4, p 557-561, July-Aug 1969. 5 p, 3 tab, 27 ref.

Descriptors: *Evaporation, *Condensation, Soils, *Irrigated land, Dew, Great Plains, Soil science, *Lysimeters, Radiation, Nocturnal, Agronomy, Bibliographies, Advection, Solar radiation, Energy balance.
Identifiers: Net radiometer, Penman method, Potential evaporation, Van Bavel method.

Evaporation from bare Sharpsburg sandy clay loam was measured using precision weighing lysimeters at Mead, Nebr, during summer and fall of 1966; many drying cycles were included. Maximum daily evaporation was about 9 mm/day in Aug and about 3 mm/day in late Oct. The ration evaporation/net radiation was frequently greater than unity, especially when the lysimeters and a one-ha area surrounding them were visibly wet and the surface of the adjacent fields was dry. A significant advectional contribution of energy is indicated. Nocturnal evaporation accounted for 10 to 50% of the total daily evaporation, the greater proportions occurring in fall. Dew was detected almost every morning. A maximum dew deposition of about 0.5 mm was measured. The Penman method yielded lower estimates of bare soil evaporation than the van Bavel combination method. Both types of estimates varied from lysimetrically measured evaporation from 3 to 50% on a daily basis. (USBR)
W70-02144

CONTROLLING SURFACE RUNOFF USING A PATCH METHOD OF STUBBLE MULCHING (RUSSIAN),
Gidrometeorologicheskii Institut, Odessa (USSR).
G. I. Shvebs.
Leningrad, Gosudarstvennyi Gidrologicheskii Inst, Sbornik Rabot po Gidrologii, No 7, p 122-126, 1967. 5 p, 1 tab, 5 ref.

Descriptors: *Stubble mulching, *Water conservation, *Mulching, *Erosion control, Agriculture, Rainfall, Soils, Snowmelt, Climates, Infiltration, Filtration, Porosity, Velocity, Water circulation, Soil erosion, Model studies, Forests.
Identifiers: *USSR, Patch-stubble mulching.

Experimental mulching studies included covering patches of soil and ground with leaves, straw, paper, etc. to increase the infiltration of rain water and decrease soil erosion. The use of the patch-stubble mulching process shows its usefulness in controlling soil erosion and surface runoff. The same method can be successfully applied in forest areas for better control of infiltration and soil-erosion processes. (Gabriel-USGS)
W70-02229

THE SOILS OF THE TRUCIAL STATES: CLASSIFICATION AND CAPABILITY,
Durham Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02G.
W70-02423

SOIL AND SALINITY FACTORS IN IRRIGATION AND DRAINAGE OF MALLEE LANDS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
For primary bibliographic entry see Field 02G.
W70-02425

UTILIZATION OF SOIL MOISTURE AND GROUNDWATER BY COTTON PLANTS IN THE CASE OF SALINE GROUNDWATER,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 05G.
W70-02432

CRESTED WHEATGRASS AND WINTERFAT EMERGENCE UNDER SIMULATED DROUTH,
Arizona Univ., Tucson. Dept. of Watershed Management.
Ervin M. Schmutz, and Mohamad Fouad Al-Rabbat.
Progressive Agriculture in Arizona, Vol 21, No 5, p 3-5, Sept-Oct 1969. 3 p, 1 tab, 3 fig.

Descriptors: *Arid climates, *Range management, *Moisture stress, *Germination, *Compacted soils, Semiarid climates, Soil moisture, Wheat grasses, Arizona, Planting management, Range grasses, Seeds, Plant growth, Emerging vegetation stage, Drought tolerance.
Identifiers: *Winterfat, *Western U.S.

Successful seeding of arid and semi-arid rangelands is uncertain owing to low soil moisture and rapid evaporation of limited supplies. The authors report a greenhouse experiment to measure effects of soil moisture, planting depth and soil compaction on emergence and survival of crested wheatgrass (Agropyron desertorum) and winterfat (Eurotia lanata). Crested wheatgrass is a cool-season, drouth-tolerant bunchgrass introduced from Asia to the arid western U.S. Winterfat is a low-growing, cool-season shrub which makes its major growth in spring and summer. The study showed that crested wheatgrass should be planted at 0.5 inch depth and winterfat on or near the surface for best emergence under either favorable or moisture stress conditions. Soil compaction before planting increased emergence of winterfat but not of crested wheatgrass. Compaction after planting did not affect either species. (Crouse-Arizona)
W70-02435

DON'T STRESS YOUR WHEAT FOR WATER,
Arizona Univ., Tucson. Dept. of Agronomy.
A. D. Day, and Suhbawatr Intalap.
Progressive Agriculture in Arizona, Vol 21, No 5, p 8-10, 1969. 3 tab.

Descriptors: *Arid lands, *Arizona, *Moisture stress, *Wheat, *Irrigation efficiency, Agriculture, Agronomic crops, Plant growth, Water requirements, Soil-water-plant relationships, Crop response, Crop production, Rates of application, Soil moisture.

In arid regions water has a dominant influence on crop production. Farmers in irrigated areas are confronted with the problem of economical use of water. It is essential to know the optimum time at which to apply limited amounts of water to obtain maximum yields. In southern Arizona wheat is planted in November or December for harvesting in late spring. The authors report a randomized block design experiment to compare 4 irrigation treatments during the winter growing period. The most critical period for moisture in the growth of wheat was found to be the jointing stage. Plants stressed at jointing stage were shorter, flowered earlier, and were more likely to lodge or to produce a significantly lower volume of grain. Moisture stress at the dough stage also resulted in lower grain volume. (Crouse-Arizona)
W70-02436

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

EQUIVALENT DISTRIBUTIONS WITH APPLICATION TO RAINFALL AS AN UPPER BOUND TO FLOOD DISTRIBUTIONS,
Victoria State Rivers and Water Supply Commission (Australia).
For primary bibliographic entry see Field 02A.
W70-02046

FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF VICTORVILLE), SAN BERNARDINO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, Apr 1969. 48 p, 23 fig, 30 plate, 5 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Mojave River (Calif), San Bernardino County (Calif), Standard project flood, Intermediate regional flood.

Flooding of the Mojave River, San Bernardino County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-02085

FLOOD PLAIN INFORMATION, UPPER TRUCKEE RIVER, SOUTH LAKE TAHOE, CALIFORNIA.
Corps of Engineers, Sacramento, Calif.

Prepared for El Dorado County. Corps Eng Flood Plain Rep, Oct 1969. 27 p, 11 fig, 11 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Lake Tahoe, Truckee River (Calif), Standard project flood, Intermediate regional flood.

Flooding of the Upper Truckee River, South Lake Tahoe, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-02086

FLOOD PLAIN INFORMATION, SANTA YNEZ RIVER, SANTA BARBARA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Prepared for Santa Barbara County Flood Control and Water Conserv Dist. Corps Eng Flood Plain Rep, Nov 1968. 33 p, 12 fig, 27 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Santa Ynez River (Calif), Santa Barbara County (Calif), Standard project flood, Intermediate regional flood.

Flooding of the Santa Ynez River, Santa Barbara County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-02087

FLOOD PLAIN INFORMATION, FLAT RIVER AREA, MISSOURI.
Corps of Engineers, St. Louis, Mo.

Corps Eng Flood Plain Rep, Dec 1968. 64 p, 22 fig, 17 plate, 18 tab.

Descriptors: *Floods, *Flood damage, *Missouri, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Flat River area (Mo), Standard project flood, Intermediate regional flood.

Flooding of the Flat River area, Missouri is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-02088

FLOOD PLAIN INFORMATION, CHENA RIVER, FAIRBANKS, ALASKA.
Corps of Engineers, Fairbanks, Alaska.

Corps Eng Flood Plain Rep, Nov 1967. 61 p, 19 fig, 26 plate, 12 tab.

Descriptors: *Floods, *Flood damage, *Alaska, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: *Fairbanks (Alas), Chena River, Standard project flood, Intermediate regional flood.

Flooding of the Chena River, Fairbanks, Alaska is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-02089

SEEPAGE TESTS IN L-D1 BORROW CANAL AT LAKE OKEECHOBEE, FLORIDA,
Geological Survey, Washington, D.C.
F. W. Meyer, and J. E. Hull.
Florida Dep Natur Resources, Bur of Geol Inform Circ No 59, 1969. 31 p, 13 fig, 1 tab, 4 ref.

Descriptors: *Seepage, *Lakes, *Canals, *Florida, Water levels, Groundwater movement, Transmissivity, Aquifers, Drainage, Water level fluctuations.
Identifiers: Lake Okeechobee (Fla).

Tests were made along Levee D-1 and the adjacent Levee D-1 borrow canal at the west side of Lake Okeechobee near Moore Haven, Florida, to determine the magnitude of the underseepage from the lake. By relating the groundwater gradients in the vicinity to the amount of pickup in a 3 1/2-mile reach of the L-D1 Canal, it was determined that the underseepage factor is about 0.9 cfs per mile per foot of head between the lake and the canal. The coefficient of transmissibility of the underlying materials is about 72,000 gpd/ft. The values are important in the design of a pumping station which will remove increased underseepage when the lake level is raised several feet. (Knapp-USGS)
W70-02095

ON SOME CHARACTERISTICS OF STORAGE DAM ASSOCIATED WITH RESERVOIR OPERATIONS,
Ministry of Irrigation and Power, New Delhi (India).
K. C. Majumdar.
J Hydrol, Vol 7, No 1, p 86-97, Nov 1968. 12 p, 5 ref.

Descriptors: *Reservoir operation, *Streamflow forecasting, *Statistical methods, Flood control, Water storage, Water management (Applied), Probability, Reservoir storage, Water supply, Water utilization.
Identifiers: Reservoir storage probability.

Some characteristics of the distribution of storage were obtained for use in reservoir operations. The distribution of storage at the end of a unit period of time was derived in terms of the known storage level at the beginning of the period, for simple as well as more complicated release schemes and for any general type of distribution of the inflows into the reservoirs. These include the probabilities of the dam becoming empty or full at the end of the unit period or at the end of each of several unit periods in succession. The distribution of outflow below the dam was obtained, including the case of a nil outflow during the period. The probability of having the desired amount of utilization and the expected amount of water that might be available during the period was also derived. Some of the practical applications of these results in reservoir operations are discussed. (Knapp-USGS)
W70-02111

CONTROL AND DRAINAGE OF WATER FROM COAL MINES.
For primary bibliographic entry see Field 06E.
W70-02128

THE INVESTMENT DECISION FOR SEEPAGE REDUCTION,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 06C.
W70-02156

CONTROL OF SEEPAGE IN EARTH DAMS,
Sacramento, Calif.
Harry R. Cedergren.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 106-112, Apr 1969. 6 p, 4 fig, 10 ref.

Descriptors: *Reservoir leakage, *Earth dams, Seepage, Leakage, Drainage, Soil mechanics.

When water is stored behind dams in reservoirs, and energy differential is created, producing pressures and forces in the water that must be controlled to prevent loss of life and damage to property. The seeping water causes two major kinds of problems: (a) those due to piping; and (b) those due to uncontrolled rise and spread of saturation. Protection from seepage usually can be provided by methods that either reduce the quantity of seepage, or control it by drainage. Although each of these two basic methods is sometimes used substantially alone, combinations of these methods usually are employed. The designer should always consider alternate methods that are available in relation to soils and geological conditions at individual sites. The experimental and analytical soil mechanics methods, when applied with experience and judgment, can virtually eliminate serious troubles and aid the designer in obtaining a high level of seepage control at the least overall cost.
W70-02164

FORECASTING THE REWORKING OF KARSTIC SHORES OF RESERVOIRS COMPOSED OF SULFATE ROCKS,
For primary bibliographic entry see Field 08E.
W70-02166

SEEPAGE DETECTION BY REMOTE SENSING,
HRB-Singer, Inc., State College, Pa. Radiometrics Lab.
For primary bibliographic entry see Field 07B.
W70-02169

FIELD EVALUATION OF SEEPAGE MEASUREMENT METHODS,
Idaho Univ., Moscow. Engineering Experiment Station; and Argicultural Research Service, Kimberly, Idaho. Snake River Research Center.
For primary bibliographic entry see Field 07B.
W70-02179

TREE SURVIVAL AND GROWTH ON FESCUE COVERED SPOIL BANKS,
Forest Service (USDA), Princeton, W. Va. Northeastern Forest Experiment Station.
William T. Plass.
USDA Forest Serv Res Note NE-90, 1968. 4 p.

Descriptors: *Vegetation effects, *Reforestation, *Strip mines, *Fescues, Vegetation establishment, Kentucky, Spoil banks, Coal mines.

In this study we found a fescue ground cover did not affect survival but did reduce the height growth of sycamore and sweetgum. It had little effect on growth of white pine and loblolly pine. (Curtis-Forest Service)
W70-02211

RESPONSE OF CROWNVETCH PLANTED ON ANTHRACITE BREAKER REFUSE,
Forest Service (USDA), Kingston, Pa. Northeastern Forest Experiment Station.
Miroslaw M. Czapowskyj, John P. Mikulecky, and Edward A. Sowa.
USDA Forest Serv Res Note NE-78, 1968. 7 p.

Descriptors: *Vegetation establishment, *Lime, *Anthracite, *Soil stabilization, *Coal mine wastes, Pennsylvania, Vegetation, Coal mines, Mine acids, Fertilization, Mulching.

Crownvetch could not be established on coal breaker refuse in the Anthracite Region of Pennsylvania without the application of lime. Mulching was beneficial but fertilizer had only slight effect. (Curtis-Forest Service)
W70-02212

LAND DISTURBANCES FROM STRIP-MINING IN EASTERN KENTUCKY,
Forest Service (USDA), Princeton, W. Va. Northeastern Forest Experiment Station.
William T. Plass.
USDA Forest Serv Res Notes: NE-52, 1966, 7 p; NE-55, 1967, 8 p; NE-68, 1967, 6 p; NE-69, 1967, 7 p; NE-71, 1967, 7 p; NE-72, 1967, 8 p.

Descriptors: *Strip mines, *Spoil banks, *Roads, Land slides, Coal mines, Kentucky.
Identifiers: Haul roads.

The six research notes covering specific coal reserve districts gives information about the amount, location, and general characteristics of areas disturbed by strip-mining. It is useful for determining economic impact, for planning reclamation programs, and for determining research needs and priorities. Aerial photographs were used to obtain reliable estimates of acreage disturbed by mining and associated coal haul roads in Eastern Kentucky as of October, 1964. Over 55,000 acres were disturbed by strip-mining and an additional 3,900 acres were disturbed by coal haul roads. (Curtis-Forest Service)
W70-02213

MATCH ADDITIVE TO SOIL TYPES FOR BEST STABILIZATION,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
Weldon K. Weigle, and George P. Williams, Jr.
Rural and Urban Roads, p 24-25, June 1968.

Descriptors: *Access routes, *Strip mines, *Road construction, *Soil additives, *Appalachian mountain region, Kentucky, Coal mines, Soil classifications, Compressive strength.

Several bituminous and chemical additives were mixed with silty-loam (A-4 (0-2)) soils collected from three eastern Kentucky counties. The effect of the additives upon the unconfined compression strength of the soils was determined for each additive at 5 and 10 percent treatment levels and one and seven day curing periods. Laboratory test results subjected to multiple comparisons showed SS1h asphalt at the 5 percent level and 7-day cure to be significantly better than all other additives studied at the treatment levels and curing periods studied. As a group the bituminous additives (RT-2, MC-3, SS1h, AE-100, AE-200) performed better at 5 percent levels than at 10 percent. Addition of NaCl and CaCl2 did not affect compressive strength, while study soils with lime at the 10 percent level had nearly twice the compressive strength as at the 5 percent level. (Williams-Forest Service)
W70-02214

FOREST SERVICE RECLAMATION RESEARCH,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
Richard D. Lane.
Mining Congr J, 54 (5): p 38-42, 1968.

Descriptors: *Research facilities, *Project planning, *Strip mines, *Spoil banks, Land reclamation, Appalachia, Hydrology, Engineering, Soil science, Vegetation establishment.

The role of the Forest Service in surface mine reclamation research is discussed along with history of research efforts. The prime objectives of strip-mine research are: (1) to develop practical surface-mining methods that cause minimum damage to forest resources and leave the mined areas in the best possible condition for restoration of these resources; and (2) to find ways to restore forest resources, compatible with adjacent land use, on surface-mined land as rapidly as possible. The research program is concentrated in four major areas--hydrology, engineering, soil science, and revegetation, but the wide variety of problems encountered demands a team approach by scientists trained in several disciplines. Study results are reported as soon as possible so as to be applied in reclamation programs. (Curtis-Forest Service)
W70-02216

INVESTIGATION OF A LINEAR MODEL TO DESCRIBE HYDROLOGIC PHENOMENON OF DRAINAGE BASINS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 02A.
W70-02238

CURRENT SEEPAGE REDUCTION RESEARCH,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Lloyd E. Myers, and Robert J. Reginato.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 75-78, Apr 1969. 4 p.

Descriptors: *Seepage, Leakage, Linings, Sealants, Reservoir leakage, Spraying.

Four different seepage control methods were described. Waterborne-asphalt emulsions are effective provided certain requirements are met. They are easy to apply and may be particularly useful in leaky reservoirs that cannot be dewatered. Sodium carbonate is a low-cost treatment for reducing seepage from unlined reservoirs in calcium-aggregated soils, which are common in the Southwestern United States. Power-spray equipment was used successfully in cleaning cracked concrete linings and applying crack sealers with a significant reduction in labor costs. Field tests showed that effective linings can be fabricated with fiberglass and asphalt emulsion. These linings are simple to install, relatively low in cost, and are strong and durable. Although additional improvements are possible and will be beneficial, these four methods and materials are useful in their present form. They should be considered by anyone confronted with a seepage problem.
W70-02260

THE EFFECT OF SEEPAGE LOSSES ON STREAM REGIMEN,
Department of the Navy, Washington, D.C.
Donald D. Del Manzo.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 30-34, Apr 1969. 5 p, 2 chart, 7 ref.

Descriptors: *Stage-discharge relations, Hydrograph analysis, Surface-groundwater relationships, Return flow, Inflow, Discharge (Water), Stream gages.

Comparison of relevant data provides substantial proof that the groundwater and surfacewater are one contiguous supply. Surfacewater correlations alone do not yield meaningful estimates of the surface outflow at the downstream gage. Inclusion of the groundwater return flows in the budgetary equation significantly improves the replication of the observed outflows. Use of the Maasland method produces satisfactory results in computing return flows. Further analysis including more of the minor water losses in detail and utilizing statistical techniques of fitting might well increase the accuracy of the model. The relative advantages of using a consumptive use pattern versus a pumping pattern should also be studied.
W70-02273

A NEW METHOD OF INSTALLING PLASTIC MEMBRANES,
Arizona Water Resources Research Center, Tucson.
C. Brent Cluff.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 86-93, Apr 1969. 7 p, 3 photo, 2 dwg, 1 tab, 9 ref.

Descriptors: *Impervious membranes, *Plastics, Linings, Seepage, Reservoir leakage, Leakage.

Plastic liners can be successfully installed and covered in one operation. The use of the plastic-laying chute on small ponds as described in this paper, or larger self-propelled plastic-laying spreaders on reservoirs, should result in a substantial saving in time and money over the more conventional methods of installing and covering plastic. Although the amount of field seaming is increased, the effect of the inherent weakness in field seaming is minimized by the ability to immediately cover the seam. The time required to make a seam in the field is reduced because the plastic is held in place by the soil cover. The chance of damage to the film is greatly lessened since the protective earth cover is applied at the same time the plastic is laid down. This is of particular advantage with the use of plastic having a low puncture resistance, such as polyethylene.
W70-02274

CHARACTERISTICS OF THERMOPLASTIC AND ELASTOMERIS LINERS,
Dow Chemical Co., Midland, Mich. Plastics Dept.; and Dow Chemical Co., Plaquemine, La. Research and Development Div.
D. H. Moeller, and J. R. Ryffel.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 79-85, Apr 1969. 7 p, 7 fig, 3 tab, 1 ref.

Descriptors: *Linings, *Elastomers, *Plastics, Seepage.

Comparisons were made of the structural, chemical, and miscellaneous properties of the four liner materials. It is hoped that this comparative chart and the discussion will provide the data for selection of liner materials on a basis of greater knowledge and understanding.
W70-02275

SOIL-CEMENT LININGS FOR WATER-CONTAINING STRUCTURES,
Portland Cement Association, San Francisco, Calif. Western Region.
For primary bibliographic entry see Field 08F.
W70-02281

FLOOD PLAIN INFORMATION, KUSKOKWIM RIVER, BETHEL, ALASKA.
Corps of Engineers, Anchorage, Alaska.

Corps Eng Flood Plain Rep, Dec 1968. 39 p, 7 fig, 9 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Alaska, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Kuskokwim River (Alas), Bethel (Alas), Standard project flood, Intermediate regional flood.

Flooding of the Kuskokwim River, Bethel, Alaska is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-02312

METHODS FOR EVALUATING THE EFFECTS OF UPSTREAM FLOOD CONTROL MEASURES ON WATERSHED YIELD,
Texas Univ., Austin. Dept. of Civil Engineering.
Stanley P. Sauer, and Frank D. Masch.
Texas Univ Hydraul Eng Lab Tech Rep HYD 13-6901, May 1969. 104 p, 22 fig, 20 tab, 40 ref.

Descriptors: *Rainfall-runoff relationships, *Water loss, *Reservoirs, *Watershed management, *Mathematical models, Forecasting, Streamflow forecasting, Statistical models, Computer programs, Evaporation, Evapotranspiration, Seepage, Reservoir design, Reservoir leakage, Flood control, Water management (Applied).
Identifiers: Watershed yield.

Methods of determining the effects of upstream flood prevention measures on watershed yield, required for optimum water resources development, are presented. Studies were conducted in 7 study areas in Texas. Reductions in annual yield ranged from 100% in dry years to 4% in a very wet year. Average reductions for an 8-year period ranged from 54% in an area having an average annual runoff of 1.37 inches to 11% in an area having average annual runoff of 6.64 inches. Mathematical models and computer programs for monthly consumption by reservoirs and watershed response to regulation consist of linear multiple regression equations relating monthly consumption to variables representative of the physical processes in evaporation from the free water surface and wetted peripheral soil, transpiration, and seepage away from the pools. These equations have standard errors of estimate ranging from 11 to 16%. Necessary parameters are determined from soil maps and reservoir design. Climatic variables are computed from first order climatological data stations. An annual inflow-outflow relationship may be used as a first approximation of the depletion of annual runoff from the controlled area of a watershed. (Knapp-USGS)
W70-02322

4B. Groundwater Management

WATER RESOURCES OF CLARK, CLEVELAND, AND DALLAS COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 03B.
W70-02055

CHARACTERISTICS OF STREAMFLOW IN THE COLVILLE RIVER BASIN, STEVENS COUNTY, WASHINGTON,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02E.
W70-02060

PRELIMINARY REPORT ON THE WATER RESOURCES ON THE LAHAINA DISTRICT, MAUI,
Geological Survey, Honolulu, Hawaii.
For primary bibliographic entry see Field 03B.
W70-02065

GEOHYDROLOGY OF HENRY AND WEAKLEY COUNTIES, TENNESSEE,
Tennessee Dept. of Conservation, Nashville. Div. of Water Resources; and Geological Survey, Nashville, Tenn.
For primary bibliographic entry see Field 03B.
W70-02071

GROUNDWATER RESOURCES OF KIMBLE COUNTY, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W70-02091

PRODUCTION AND UTILIZATION OF WATER IN THE METROPOLITAN AREA OF JACKSONVILLE, FLORIDA,
Geological Survey, Jacksonville, Fla.
For primary bibliographic entry see Field 03D.
W70-02092

EFFECT OF IRRIGATION ON THE CHEMICAL QUALITY OF LOW STREAMFLOW ADJACENT TO CEDAR BLUFF IRRIGATION DISTRICT, KANSAS,
Geological Survey, Lawrence, Kans.
For primary bibliographic entry see Field 05C.
W70-02093

SALT-WATER ENCROACHMENT IN AQUIFERS OF THE BATON ROUGE AREA, LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02L.
W70-02094

VALUATION OF A GROUNDWATER SUPPLY FOR MANAGEMENT AND DEVELOPMENT,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 06B.
W70-02110

CONTROL AND DRAINAGE OF WATER FROM COAL MINES.
For primary bibliographic entry see Field 06E.
W70-02128

FACTORS AFFECTING INFILTRATION AND RECHARGE IN A LOESS COVERED BASIN,
Idaho Univ., Moscow.
Roy E. Williams, and David W. Allman.
J Hydrol, Vol 8, No 3, p 265-281, July 1969. 17 p, 13 fig, 16 ref.

Descriptors: *Groundwater recharge, *Artificial recharge, *Infiltration, *Loess, *Percolation, Groundwater, Water table, Crops, Infiltrometers, Root systems, Hydrogeology, Piezometers, Aquifers, Idaho, Dyes, Tracers, Hydrographs, Soil erosion, Bibliographies.
Identifiers: Holes, Groundwater system.

Hydrographs of shallow piezometers installed in a basin overlain primarily by loess reveal that water infiltrating and percolating through the loess recharges groundwater. Local gravity groundwater flow systems adjacent to some intermittent streams thereby are established. Relief on the water table is at a maximum during late winter or spring, but decreases steadily through the summer when dry weather and maximal evapotranspiration minimize recharge. Cultivation practices and type of crop grown are 2 important factors that make the loess susceptible to infiltration and percolation. Smooth, heavily worked surfaces (commonly planted in winter wheat) act as a major limitation to infiltration capacity; soil moisture concomitantly is low beneath such surfaces. Root mats developed beneath grassy surfaces provide optimal conditions for infiltration and, consequently, for recharge. Measured infiltration capacities are often influenced by near-vertical tubular openings extending at least 30 ft deep in the loess. Tracer studies indicate that when sufficient water is available and when surficial infiltration capacity is sufficiently high to form a zone of positive pressure above these openings, water is conducted ahead of the saturation front. (USBR)
W70-02154

FEASIBILITY STUDY OF ELECTRICAL GEOPHYSICAL METHODS IN THE DETERMINATION OF SUBSURFACE HYDROGEOLOGIC ENVIRONMENTS IN THE PIEDMONT AREA OF SOUTH CAROLINA,
Clemson Univ., S.C. Water Resources Research Inst.
For primary bibliographic entry see Field 07B.
W70-02241

RECHARGE FROM INDUCED STREAMBED INFILTRATION UNDER VARYING GROUNDWATER-LEVEL CONDITIONS,
W. C. Walton.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 17-22, Apr 1969. 6 p, 1 fig, 4 map, 1 tab, 3 ref.

Descriptors: *Induced infiltration, *Groundwater recharge, Aquifers, Water table, Surface-groundwater relationships, Analog models, Simulated analysis, Streambeds.

Little, if any, attention has been given to the complex nature of recharge from induced streambed infiltration under varying groundwater-level conditions. Streambeds are often simulated in mathematical models by hypothetical recharge boundaries located with aquifer-test data. Under heavy pumping, the recharge boundaries may not correctly simulate leakage through streambeds and computed drawdowns may be greatly in error. Streambeds have been simulated in analog models by a ground wire which is equivalent to simulating a streambed as a hypothetical recharge boundary. In some analog models, the streambed is simulated with vertical arrays of resistors. Simulation of induced infiltration by a hypothetical recharge boundary, such as a ground wire or simple vertical arrays of resistors has been shown to be incorrect for certain conditions, and will lead to misleading estimates of the potential yields of aquifer unless the pumping conditions are such that the water table is not lowered below the streambed and maximum induced infiltration rates do not occur. In evaluating groundwater resources, streambeds must be simulated in mathematical and analog models in such a way that the following conditions are considered: (1) Leakage of water through a streambed is directly proportional to the drawdown beneath the streambed until the water table declines below the streambed. Thereafter, induced infiltration remains constant providing the stream stage and temperature remains stationary. (2) Provided that the water table remains below the streambed, leakage of water through a streambed is directly proportional to the average depth of water in the stream and varies with stream-stage changes and changes in the temperature of the surface water.
W70-02263

DEVELOPMENT OF SYSTEMS FOR GROUNDWATER RECHARGE INTO THE OGALLALA FORMATION,
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.
Marvin J. Dvoracek, and Rolland Z. Wheaton.
Available from the Clearinghouse as PB-188 504, $3.00 in paper copy, $0.65 in microfiche. Research Project Technical Completion Report, Texas Tech Water Resources Center Report WRC 69-5, May 1969. 22 p, 3 tab, 3 fig, 21 ref. OWRR Project B-016-TEX.

Descriptors: *Groundwater recharge, *Well recharge, *Pit recharge, *Playa lakes, Sedimentation, Ogallala formation, Filter systems.

Constructed pits were evaluated as mechanisms for artificial groundwater recharge into the Ogallala Formation of the High Plains of Texas. The pits were located on the outer periphery of a playa lake (wet weather lake) and possessed the surface dimensions of 250 feet x 100 feet and 10 feet deep. Recharge rates of up to 1.5 feet per day of pit water level decline were noted, but continued recharge of the high sediment content waters reduced rates in some instances to 0.1 foot per day. The pits proved to be efficient recharge mechanisms when the sediment problem was nonexistant. Drying and freezing or overwintering of this sediment permitted partial recovery of recharge rates without additional maintenance. Buried tile drains used as filter systems for water to be used in recharge were studied. Filter media of sands, gravels, sand-gravel combinations, and organic material were used with sands and gravels proving most effective. Waters resulting from this system were recharged through a multipurpose well without detrimental effects. Some clarification of water is required for economical and efficient artificial recharge of surface runoff waters through multiple purpose wells and constructed pits.
W70-02282

4C. Effects on Water of Man's Non-Water Activities

FOREST ZONE HELPS MINIMIZE FLOODING IN THE DRIFTLESS AREA,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
Willie R. Curtis.
J Soil and Water Conserv, 21 (3): p 101-102, 1966.

Descriptors: *Storm runoff, *Diversion, *Flow measurement, *Water conservation, Runoff, Overland flow, Erosion control, Flood control, Watershed management, Wisconsin.

Surface runoff from ridge-top farmland in the Driftless Area is at least partially dissipated within the forest zone below. Much runoff leaving upland fields did not reach the valleys below as surface flow.
W70-02203

SIMPLE PRACTICES ALONG FOREST EDGE REDUCE UPLAND RUNOFF,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04D.
W70-02204

GRASSES AND LEGUMES FOR COVER ON ACID STRIP-MINE SPOILS,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
Willis G. Vogel, and William A. Berg.
J Soil and Water Conserv, 23 (3): p 89-91, 1968.

Descriptors: *Strip mines, *Cover crops, *Grasses, *Legumes, *Vegetation establishment, Spoil banks, Reclamation, Revegetation, Kentucky, Hydrogen-ion concentration, Nutrient requirements, Plant growth, Soil chemical properties.
Identifiers: *Acidic spoils, *Quick cover, Strip-mine reclamation.

A vegetation cover is needed on most strip-mine spoils immediately after mining to reduce runoff and erosion. Field experiments showed that fertilized weeping lovegrass provided cover on acid spoils faster than any other perennial grass or legume tested. Greenhouse studies showed that weeping lovegrass also was more tolerant of extremely acid spoils (pH 4.0 - 4.5), than any of the other species tested. Switchgrass was only slightly less tolerant of acid spoils than weeping lovegrass but more tolerant than K-31 tall fescue. However, satisfactory cover is established too slowly by switchgrass. Even the more acid tolerant legumes grew poorly and did not nodulate in most of the acid spoils with pH below 4.5.
W70-02206

HYDROLOGIC EFFECTS OF PRESCRIBED BURNING ON ABANDONED FIELDS IN NORTHERN MISSISSIPPI,
Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station.
For primary bibliographic entry see Field 04D.
W70-02207

HYDROLOGY OF CONTOUR STRIP MINES IN THE APPALACHIAN REGION OF THE UNITED STATES,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
Grant Davis.
In: International Union of Forest Res Organizations Proc, 13th Congress, Munich, p 420-443, Sept 1967.

Descriptors: *Watershed management, *Surface drainage, *Strip mines, *Spoil banks, Hydrology, Coal mines, Surface runoff, Water pollution sources, Appalachia, Water resources, Streamflow.

Contour strip-mining may have profound effects on stormflow, sediment load, and water quality of streams in a watershed. The degree of impact depends upon the proportion of area mined, hydrologic characteristics of the spoil material, topography of the watershed, and other factors. For the most part, standard techniques are used to measure the hydrology of strip-mined watersheds; but modifications are sometimes necessary. Because mining is extensive and subject to little experimental control, the multi-watershed approach

offers many advantages as a method for determining the hydrologic effects of such mining. (Curtis-Forest Service)
W70-02217

A DISTRIBUTED LINEAR REPRESENTATION OF SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-02286

ROADSIDE EROSION SURVEY,
Soil Conservation Service, Madison, Wis.
For primary bibliographic entry see Field 02J.
W70-02327

4D. Watershed Protection

VARIATIONS IN LOW-WATER STREAMBED ELEVATIONS AT SELECTED STREAM-GAGING STATIONS IN NORTHWESTERN CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W70-02045

THE INFLUENCE OF EROSION BELOW CHUTES ON THE CONDITIONS OF NAVIGATION (FRENCH),
Institut d'Armenagement et d'Economie de l'Eau, Warsaw (Poland).
For primary bibliographic entry see Field 08B.
W70-02106

CONTROL AND DRAINAGE OF WATER FROM COAL MINES.
For primary bibliographic entry see Field 06E.
W70-02128

SIMPLE PRACTICES ALONG FOREST EDGE REDUCE UPLAND RUNOFF,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
Willie R. Curtis.
J Soil and Water Conserv, 22 (1): p 25-26, 1967.

Descriptors: *Overland flow, *Storm runoff, *Outlets, *Diversion, *Water spreading, Runoff, Infiltration, Terracing, Flood control, Watershed management, Wisconsin.

Overland runoff from ridgetop farmland has been adequately controlled by diverting flow from natural drainageways to forested slopes when the diversion outlets have been treated. Outlet treatments consisted of natural forest, logs, and contour trenches.
W70-02204

HYDROLOGIC EFFECTS OF PRESCRIBED BURNING ON ABANDONED FIELDS IN NORTHERN MISSISSIPPI,
Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station.
S. J. Ursic.
USDA Forest Serv Res Pap SO-46, 1969. 20 p.

Descriptors: *Burning, *Storm runoff, *Accelerated erosion, *Overland flow, *Peak discharge, Sediment yield, Rainfall-runoff relationships, Small watersheds, Watershed management, Grasses, Soil erosion, Mississippi.
Identifiers: *Experimental watersheds, *Prescribed burning, *Post-fire erosion.

Reports 3-year results of a prescribed burn on two small watersheds supporting a cover of native grass. Comparisons were against an unburned control watershed. Variables included stormflows, overland flows, peak discharges, and sediment yields.
W70-02207

ACIDITY AND PLANT-AVAILABLE PHOSPHORUS IN STRATA OVERLYING COAL SEAMS,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
William A. Berg, and Robert F. May.
Mining Congr J, 55 (3): p 31-34, 1969.

Descriptors: *Strip mines, *Overburden, *Stratigraphy, *Soil chemical properties, Kentucky, Hydrogen-ion concentration, Phosphates, Reclamation, Strip mine wastes, Coal mines, Mining, Engineering, Shales, Sandstones, Spoil banks, Nutrient requirements, Mine acids.
Identifiers: *Acidic spoils, *Plant-available phosphorus, *Strip-mine reclamation, Overburden movement and placement, Acid strata, Rider coal, Bone coal.

Samples of visibly different strata were collected from highwall sections at six strip-mines in eastern Kentucky. Hydrogen-ion concentrations (pH) and plant-available phosphorus (Bray no. 1) were determined on the samples. Most of the extremely acid strata (pH below 4.0) were rider coal seams, bone coal, or thin shale strata just above or below the rider coal or bone coal. These materials can be recognized visually in the field suggesting the use of mining techniques for separating this extremely acid material and burying it under less acid overburden. Extremely acid shales and sandstones occurred less frequently but are not visually distinguishable from non-acid shales and sandstones. A few strata at each highwall section tested moderate in plant-available phosphorus, but the majority of the strata tested low to very low. The position of the strata with moderate phosphorus levels was inconsistent among highwall sections even on the same strip mine. Thus mining to place spoils containing phosphorus in an exposed position for vegetation appears impractical. (Vogel-Forest Service)
W70-02208

SPOIL BANK STABILITY IN EASTERN KENTUCKY,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 08D.
W70-02210

EROSION FROM ABANDONED COAL-HAUL ROADS,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
Weldon K. Weigle.
J Soil and Water Conserv, 21 (3): 1966. 1 p.

Descriptors: *Appalachian mountain region, *Strip mines, *Access routes, *Washouts, *Gully erosion, Watershed management, Kentucky, Coal mines.

A 1964 survey showed approximately ten percent of the area disturbed by strip mining in eastern Kentucky was due to the construction of coal haul roads. If not maintained for further use, or if abandoned without adequate reclamation, these roads are detrimental to the water quality of streams flowing from mined watersheds. Eight coal haul roads located in Bell, Harlan, and Perry Counties of eastern Kentucky were studied after periods of abandonment ranging from eight months to two years. The mean erosion from roads in sandy silt was 2.6 inches, and from roads in clayey silt was five inches per year across the entire width of the road prism. The mean prism width was found to be 65 feet. (Williams-Forest Service)
W70-02215

CONSERVATION IN A NEW TOWN,
Soil Conservation Service, Hyattsville, Md.
For primary bibliographic entry see Field 02J.
W70-02329

MORPHOLOGY, STRUCTURE, AND EVOLUTION OF A CHANNEL ISLAND IN THE BARAKAR RIVER, BARAKAR, WEST BENGAL,
Indian Inst. of Tech., Kharagpur. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02J.
W70-02331

INTERDISCIPLINARY TEAMWORK IN WATERSHED PLANNING,
Soil Conservation Service, Spartanburg, S.C.
For primary bibliographic entry see Field 06B.
W70-02377

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

BEHAVIOR OF XENON 133 GAS AFTER INJECTION UNDERGROUND,
Geological Survey, Idaho Falls, Idaho.
J. B. Robertson.
Available from the Clearinghouse as IDO-22051, TID-4500, $3.00 for paper copy; $0.65 in microfiche. Geol Surv Open-file Rep, Ref No IDO-22051, July 1969. 37 p, 14 fig, 2 tab, 10 ref.

Descriptors: *Injection wells, *Tracers, *Radioisotopes, *Disposal, *Radioactive wastes, Gases, Tracking techniques, Monitoring, Permeability, Aquifers, Aquicludes, Diffusion, Seepage, Pressure, Mathematical models, On-site tests, On-site investigations.
Identifiers: Gas injection.

Xe-133 gas was injected rapidly under pressures of 1.5 to 1.65 psig with one million cubic feet of air into permeable basalt strata at the National Reactor Testing Station, Idaho. The subsurface Xe-133 was monitored by Geiger-Muller detectors and by air samples from observation wells surrounding the injection well. Underground distribution patterns after injection pressures had dissipated were evaluated by materials-balance analyses. Molecular diffusion rates of Xe-133 from the ground were estimated using a simplified numerical model. A maximum flux rate of 2,560 micro/Ci/hr from a ground-atmosphere interface of 2.88 million sq ft was calculated for the first day after injection. Total diffusion loss was estimated to be 0.37 Ci for the total area during the 26-day observation period. The calculated rates had fairly good agreement with the flux rates at the ground surface. Molecular diffusion and barometric effects could produce the flux rates measured; however, the rates were too low to remove a significant portion of the 987 Ci of Xe-133, nearly all of which remained underground and decayed. The general methods and techniques used for the diffusion, materials balance, and barometric analyses were generally satisfactory and be applied to future underground gas-injection problems. (Knapp-USGS)
W70-02072

STUDY OF CHLORINATED PESTICIDES IN OYSTERS AND ESTUARINE ENVIRONMENT OF THE MOBILE BAY AREA,
Gulf Coast Marine Health Sciences Lab.
For primary bibliographic entry see Field 05B.
W70-02100

ION-SELECTIVE ELECTRODES -- THEORY AND APPLICATIONS IN WATER ANALYSIS,
Pittsburgh Univ., Pa. Graduate School of Public Health.
Julian B. Andelman.
J Water Pollut Contr Federation, Vol 40, No 11, Part 1, p 1844-1860, Nov 1968. 17 p, 4 fig, 2 tab, 35 ref.

Descriptors: *Electrodes, *Ions, *Water analysis, Analytical techniques, Alkali metals, Chemical

potential, Phosphates, Nitrates, Sulfates, Halides, Copper, Magnesium, Calcium, Instrumentation, Hardness (Water), Water chemistry.
Identifiers: *Ion-selective electrodes, Activity, Activity coefficient, Concentration.

Recently, several electrodes for such ions as flouride, nitrate, sulfide, sodium, potassium, calcium, and total hardness (divalent ions) have become commercially available. The potentials measured by these electrodes, which sense activity rather than concentration, are influenced to varying extents by the presence of ions other than those whose measurements are desired. The relationships of these effects to be measured potentials are discussed, as are techniques for interpretation in terms of ion concentrations, rather than activities. Among the advantages of these electrodes for water analysis are their speed and their potential for in situ monitoring of ions in natural and treated waters. Some applications of these electrodes for water analysis are discussed, including comparisons between their analyses and those obtained by other techniques. (Carstea-USGS)
W70-02112

PESTICIDES,
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 05G.
W70-02132

EFFECT OF pH ON THE RATE OF BOD OF WASTEWATER,
Maryland Univ., College Park. Dept. of Chemistry; Birla Inst. of Tech. and Science, Pilani (India). Dept. of Civil Engineering; and Roorkee Univ. (India). Dept. of Chemistry.
S. K. Mukherjee, A. K. Chatterji, and I. P. Saraswat.
J Water Pollut Contr Federation, Vol 40, No 11, Part 1, p 1934-1939, Nov 1968. 6 p, 5 fig, 2 tab, 13 ref.

Descriptors: *Biochemical oxygen demand, *Acidity, *Waste water (Pollution), Domestic wastes, Temperature, Alkalinity, Water quality, Analytical techniques, Rates, Water properties.
Identifiers: Biochemical oxygen demand rate.

The influence of pH on the rate constant, k, and the ultimate demand, L, was studied in the 6 to 8 range and at temperatures from 20 deg to 37 deg C. Values of k at all test temperatures were maximum in the acidic range, minimum in the neutral zone, and tend to decrease as pH goes up. Values of L tend to decrease with an increase in pH, increase in the neutral zone, and decrease in the alkaline pH range. (Carstea-USGS)
W70-02308

STREAM EQUATIONS AND METHOD OF CHARACTERISTICS,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
Dominic M. Di Toro.
ASCE Proc, J Sanit Eng Div, Vol 95, Pap 6723, No SA4, p 699-703, Aug 1969. 5 p, 13 ref.

Descriptors: *Path of pollutants, *Water quality, *Streamflow, *Mathematical models, Digital computers, Computer programs, Biochemical oxygen demand, Dissolved oxygen.
Identifiers: *Method of characteristics.

The method of characteristics is applied to the form of the one dimensional continuity equation that is commonly employed in the analysis of the distribution of dissolved substances, such as BOD and dissolved oxygen, in natural rivers and streams. The resulting pair of ordinary differential equations can be solved numerically using widely available computer programs. This method appears to be superior to methods based on approximations using a rectangular grid in terms of the accuracy obtained and the computer time and memory required. (Knapp-USGS)
W70-02326

DEGRADATION OF DDT IN ATLANTIC SALMON (SALMO SALAR),
New Brunswick Univ., Federicton. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W70-02341

SIGNIFICANCE OF CHLORINATED HYDROCARBON RESIDUES TO BREEDING PELICANS AND CORMORANTS,
Wisconsin Univ., Madison. Dept. of Wildlife Ecology; and California Univ., Berkeley. Dept. of Nutritional Sciences.
For primary bibliographic entry see Field 05C.
W70-02342

A SIMPLIFIED FLOW-THROUGH APPARATUS FOR MAINTAINING FIXED CONCENTRATIONS OF TOXICANTS IN WATER,
Mississippi State Univ., State College. Dept. of Zoology.
W. David Burke, and Denzel E. Ferguson.
Trans of Am Fish Soc, Vol 97, No 4, p 498-501, 1968. 1 tab, 1 fig, 3 ref. ES00086-03 from Office of Resources Devel and UI 00348-01 from Nat Center for Urban and Industrial Health, U S Pub Hlt Service.

Descriptors: *Installation, *Laboratory equipment, Automatic control, Research equipment, Flow control, Flow rates, Design, Application equipment.
Identifiers: *Toxicant diluting systems, Static systems, Flow-through systems.

The objectionable features of using static tests to determine the toxicity of pesticides to aquatic organisms are described. An accurate and inexpensive flow-through system in which test solutions are constantly renewed, is described. It consists of a toxicant source (acetone+ toxicant) and a water source. These are mixed in a baffled chamber. Flow rate is determined by tube diameter, height of water column above the outlet tube, and total length of outlet tube. From the baffled mixing chamber the diluted stock solution is passed into the test tanks at different flow rates and at different concentrations. The performance of this system was evaluated and was found to be exceedingly accurate. (Sjolseth-Washington)
W70-02352

IN VITRO DEGRADATION OF DDT BY INTESTINAL CONTENTS OF ATLANTIC SALMON (SALMO SALAR),
New Brunswick Univ., Federicton. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W70-02354

PERSISTENCE OF DDT IN CRAYFISH IN A NATURAL ENVIRONMENT,
Maine Univ., Orono.
For primary bibliographic entry see Field 05C.
W70-02357

BACTERIAL RESPONSE TO THE SOIL ENVIRONMENT,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 05B.
W70-02442

5B. Sources of Pollution

WATER QUALITY AND DISCHARGE OF STREAMS IN THE LEHIGH RIVER BASIN, PENNSYLVANIA,
Geological Survey, Washington, D.C.
Edward F. McCarren, and Walter B. Keighton.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 -- Price $0.35. Geol Surv Water-Supply Pap 1879-H, p H1-H48, 1969. 48 p, 11 fig, 6 tab, 12 ref.

Descriptors: *Streamflow, *Water quality, *Data collections, *Pennsylvania, Acid mine water, Hydrologic data, Solutes, Dissolved oxygen, Water pollution sources, Hydrographs, Water temperature, Discharge (Water).
Identifiers: Lehigh River Basin (Penn).

The Lehigh River, 100 miles long, is the second largest tributary to the Delaware River. It drains 1,364 sq mi in 4 physiographic provinces. The Lehigh River basin includes mountainous and forested areas, broad agricultural valleys and areas of urban and industrial development. In the headwaters the water is of good quality and has a low concentration of solutes. Downstream, some tributaries receive coal-mine drainage and become acidic; others drain areas underlain by limestone and acquire alkaline characteristics. The alkaline streams neutralize and dilute the acid mine water where they mix. The dissolved-oxygen content of river water, which is high in the upper reaches of the stream, is reduced in the lower reaches because of lower turbulence, higher temperature, and the respiration of organisms. Most of the river water requires only moderate treatment for industrial use and public distribution throughout the Lehigh River valley. At times, however, some segments of the main river and its tributaries transport industrial wastes and acid coal-mine drainage. Since May 1966 an instrument installed by the U.S. Geological Survey at Easton, Pa., has continuously recorded such water-quality parameters as specific conductance, temperature, and dissolved oxygen content. Streamflow and water quality data are tabulated. (Knapp-USGS)
W70-02052

WATER LOAD OF URANIUM, RADIUM, AND GROSS BETA ACTIVITY AT SELECTED GAGING STATIONS, WATER YEAR 1960-61,
Geological Survey, Washington, D.C.
E. C. Mallory, J. O. Johnson, Jr., and R. C. Scott.
Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 -- Price $0.65. Geol Surv Water-Supply Pap 1535-O, p 01-031, 1969. 31 p, 1 fig, 1 plate, 8 tab, 14 ref.

Descriptors: *Radioisotopes, *Water quality, *Water chemistry, *Data collections, Water analysis, Chemical analysis, Streamflow, Solutes, Radiochemical analysis, Uranium radioisotopes.
Identifiers: Radium, Radiogeochemical prospecting.

Water samples were collected from 36 rivers during low, medium and high flows. The drainage areas above the sampling sites represent about 55% of continental United States (including 86,000 sq mi of Alaska) and 155,000 sq mi of Canada. During the 1960-61 water year the total uranium-solute load ranged from about 100 pounds contributed by the Nezinscot River to 695,000 pounds contributed by the Mississippi River. The calculated total uranium-solute load of the rivers sampled was used to estimate that about 2 million pounds of uranium was carried in solution from the continental United States to the oceans during this water year. The calculated radium-solute load for the sampling period ranged from about 0.000025 pounds for the Nezinscot River to 0.25 pounds for the Mississippi River. The gross solute load of radium from the conterminous United States to the oceans for water year 1960-61 was estimated to be about 0.67 pounds. (Knapp-USGS)
W70-02054

STUDY OF CHLORINATED PESTICIDES IN OYSTERS AND ESTUARINE ENVIRONMENT OF THE MOBILE BAY AREA,
Gulf Coast Marine Health Sciences Lab.
V. L. Casper, R. J. Hammerstrom, E. A. Robertson, Jr., J. C. Brigg, Jr., and J. L. Gaines.
Dep Health, Educ and Welfare, Public Health Serv Rep, 1969. 47 p, 3 fig, 10 tab, 20 ref, 3 append.

Descriptors: *Pesticides, *Oysters, *Bays, *Estuaries, *Public health, Water pollution effects, Water pollution sources, Chlorinated hydrocarbon pesticides, DDT, Dieldrin, Endrin, Heptachlor.

Identifiers: DDE, DDD, Methoxychlor, Toxaphene, Mobile Bay (Ala).

A study to gain information on the amount of chlorinated pesticides in oysters and estuarine waters of the Mobile Bay area was made with particular reference to public health. Oyster, water, and bottom sediment samples were taken from Mobile Bay. Water and bottom sediment samples were collected from the Tensaw River immediately north of Mobile Bay. DDT and its metabolites DDD and DDE were found more frequently and at higher levels than were the other chlorinated pesticides. DDT was found in 99% of the oyster samples in the range of less than 0.01 to 0.58 ppm. DDD and DDE were detected in all 82 oyster samples in the ranges of 0.01 to 0.72 ppm and 0.01 and 2.31 ppm, respectively. DDT, DDD, and DDE were detected in 79, 80, and 84%, respectively, of the 131 water samples. The highest values for DDT, DDD, and DDE in the water samples were 0.008 ppm, 0.001 ppm, and 0.002 ppm, respectively. (Knapp-USGS)
W70-02100

WATER QUALITY IN THE DELAWARE ESTUARY FOR TWO YEARS OF DROUGHT: 1965 AND 1966 FROM TRENTON, NEW JERSEY TO REEDY ISLAND, DELAWARE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02L.
W70-02119

RELATION OF AGRICULTURE TO GROUNDWATER POLLUTION: A REVIEW,
North Carolina State Univ., Raleigh.
J. W. D. Robbins, and G. J. Kriz.
Trans Amer Soc Agr Eng, Vol 12, No 3, p 397-403, May-June 1969. 7 p, 2 tab, 97 ref.

Descriptors: *Agricultural engineering, *Groundwater, *Pollutants, *Farm wastes, Agriculture, Pollution abatement, Farm management, Waste water (Pollution), Pesticides, Insecticides, Herbicides, Bibliographies, Saline water, Irrigation water, Waste water disposal, Waste disposal, Water pollution, Water pollution control, Water Pollution sources.
Identifiers: Groundwater quality, Pollution control.

Groundwater is a water resource and a potential medium for receiving wastes. Agricultural enterprises produce wastes that can lead to rapid degradation of groundwater. Agricultural engineers are responsible for evaluating agricultural groundwater pollution problems and recommending control and abatement measures. The purpose of this paper is to orient agricultural engineers on groundwater pollution problems caused by agricultural practices in 3 general areas: (1) evaluation of groundwater as a receiving medium for agricultural wastes; (2) characterization of the source of the pollutants; and (3) delineation of the types of solutions needed for agricultural groundwater quality problems. Agricultural groundwater pollutants reviewed are animal wastes, fertilizers, pesticides, plant residues, and saline waste water. (USBR)
W70-02161

VIRUS MOVEMENT IN GROUNDWATER SYSTEMS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
William A. Drewry.
Available from the Clearinghouse as PB-188 285, $3.00 in paper copy, $0.65 in microfiche. Research Project Technical Completion Report, Arkansas Water Resources Research Center, Publication No 4, Feb 1969. 76 p, 41 tab, 13 fig, 11 ref. OWRR Project A-005-ARK.

Descriptors: *Viruses, Bacteriophage, *Water pollution, Septic tanks, *Soil disposal fields, Soil contamination.

The extent is investigated to which soil acts as an agent in the transmission of waterborne viruses. Since many waterborne outbreaks of viral diseases have involved small wellwater supplies contaminated by effluents from subsurface wastewater disposal systems, there is a great need for such information. Results show that virus adsorption by soils is greatly affected by the pH, ionic strength, and soil-water ratio of the soil-water system and various soil properties. It is shown that one cannot predict the relative virus adsorbing ability of a particular soil based on the various tests normally used to characterize a soil. Virus movement through a continuous stratum of common soil under gravity flow conditions and with intermittent dosing should present no health hazard if usual public health practices relating to locating water supply wells are followed. Test results indicate no greater or lesser movement of virus through soils with a highly polluted water than with a non-polluted water.
W70-02240

LIMNOLOGICAL STUDIES IN CONNECTICUT. VIII. THE NIACIN CYCLE IN A SMALL INLAND LAKE,
Yale Univ., New Haven, Conn. Osborn Zoological Lab.
For primary bibliographic entry see Field 02H.
W70-02250

PRODUCTION, DISPOSAL, AND USE OF WHEY IN VERMONT,
Vermont Univ., Burlington. Dept. of Agricultural Economics; and Vermont Univ., Dept. of Animal and Dairy Science.
For primary bibliographic entry see Field 05E.
W70-02299

INJECTION OF GAS INTO THE LITHOSPHERE AT THE NATIONAL REACTOR TESTING STATION.
Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.

Bruce L. Schmalz, Compiler. Atomic Energy Res and Develop Rep IDO-12069, Idaho Oper Office, June 1969. 166 p, 79 fig, 27 tab, 21 ref, 3 ref, 3 append.

Descriptors: *Waste disposal, *Radioactive waste disposal, *Gases, *Injection wells, *Idaho, Nuclear wastes, Radioactive wastes, Air pollution, Permeability, Diffusion, Mixing, Tracers, Monitoring, Tracking techniques.
Identifiers: Gas injection.

To study the feasibility of disposing of radioactive gas wastes in injection wells at the National Reactor Test Station, a test was conducted by injecting 1 million cu ft of air, containing 1,000 Ci xenon-133, into a porous zone 120 feet below the land surface. The movement of this gas was studied by means of air samples and radiation detection equipment placed in surrounding monitoring wells. Air samples also were collected at the land surface and from strategic locations in the atmosphere. Analysis of the results using diffusion equations verified that the movement could be explained on this basis. Variation of estimated flux from that measured was explained on the basis of barometric influences. It was estimated that 0.5 of 1,000 Ci injected escaped to the atmosphere during a 24-day period. This amount resulted in concentrations that were less than the mean concentration of xenon-133 in the injected air by a factor of 100,000,000. Mathematical models describing the flow by convective forces created by injection also were tested and found adequate for making engineering estimates. (Knapp-USGS)
W70-02321

A SPECIAL CASE, THERMAL DIGITAL SIMULATION OF WASTE HEAT DISCHARGES,
Battelle-Northwest, Richland, Wash.
R. T. Jaske, and J. L. Spurgeon.
Water Research, Vol 2, 1968, p 777-802. 10 ref. AEC Contract No AT (45-1) 1830.

Descriptors: *Heat transfer, *Mathematical models, *Computer models, Turbulence, *Thermal pollution, Energy budget, Temperature, Heat balance, Thermodynamic behavior, Streams.

The description and designs of mathematical models for the prediction of conservative and nonconservative materials in streams is presented. The major emphasis is on the prediction of temperature changes in streams due to energy plants using atomic energy. The hydraulic part of the model is based on similarity of turbulent flow which leads to the conclusion that there is a fixed relationship between the volume and the surface area of a section of a universal channel. The energy budget method was used for the evaluation of the mass or heat balance in a section of the model. The model considers the weather data as one of the major inputs. The input data are grouped into three parts: (1) weather parameters; (2) reservoir or river dimensional data; and (3) advected heat or material cards up to 9300 individual cards. The particular procedure was developed for density currents which occur with densimetric Froude numbers less than 0.26. The model permits the advection of heat into any of the input defined troughs. Two streams carrying heated discharges were used for testing of the model. (Novotny-Vanderbilt)
W70-02398

THERMAL REQUIREMENTS TO PROTECT AQUATIC LIFE IN TEXAS RESERVOIRS,
Texas Electric Service Co., Fort Worth.
H. R. Drew, and J. E. Tilton.
Water Pollution Control Federation 42nd Annual Conference, Oct 5-10, 1969, Dallas, Texas. Mss 19 p, 3 fig, 17 ref.

Descriptors: *Temperature, *Reservoirs, *Fish, *Thermal pollution, Nutrient requirements, Electric power, Water conservation.
Identifiers: Cooling ponds, Beneficial effects.

Streams in Texas vary in temperature from 33 deg F to 110 deg F. Fish and other aquatic organisms have adapted to these varied natural conditions. Fish have been taken from natural waters of 102 deg F by state biologists. The conditions in the man-made reservoirs are different. The game species in these reservoirs show exceptional growth in the first two years and then start declining rapidly. The reason for this decline with age are the absence of native game species adapted to the reservoir environment and a loss of fertility. Inorganics leached from the soil are utilized in the productivity chain. With age these minerals are lost through absorption by living organisms which subsequently die and settle to the bottom. Because of stratification the nutrients do not re-enter the circulatory systems. The problem of utilizing nutrient material available in the bottom layers has been overcome to some extent in small ponds by using aerators or mixers. Extensive feeding programs at fish hatcheries in Texas have shown maximum growth of channel catfish and largemouth bass at water temperature of 75 deg F. The continuous recirculation of water within the reservoirs by the powerplant results in a mixing effect. It will also result in increased aeration. Due to these factors the powerplant reservoirs have remained highly productive since impoundment and have maintained a well balanced fish population. (Upadhyaya-Vanderbilt)
W70-02400

SOME ASPECTS CONCERNING THE DISCHARGE OF WATERS FROM ELECTRIC POWER PLANTS USED IN THE TRANSPORT OF ASHES (FRENCH),
Institute of Hydrotechnical Research, Bucharest (Rumania).
V. Ghederim, and I. Ghita.
Tribune Centre Belge Etude et de Documentation des Eaux, No 292, p 134-138, Mar 1968. 9 ref.

Descriptors: *Thermal powerplants, *Pollutant identification, *Water quality, Path of pollutants, Water pollution, Water pollution sources, Sedimentation, Alkalinity, Suspension, Turbidity, Sediment transport, Settling basins.

Research was performed in 2 power stations, one of 120 MW capacity (A) and the other of 200 MW capacity (B) in order to establish the design of a new station of 700 MW capacity (C), and the disposal of its waste water. A used low-quality coal (90%) and natural gas (10%) as fuel. The waste water had a high alkalinity, and large quantities of minerals settled easily without coagulants. The waste water flow was 300-400 l/s. After settling, the pH decreased as well as the sulfide and alkalinity. B used a coal with lower ash content and higher caloric value (50%) and natural gas (50%). The raw waste water had an alkalinity greater than A, suspended matter similar to A, and less sulfide. The flow was 200-300 l/s. After simple settling as in A, the pH, alkalinity, and sulfide decreased. The ashes coming from the dust of the combustion gas and the soot from the coal were mixed with carrying waters (10/1) (for the coal to be used in the new station). The pH, alkalinity, and the sulfide content were similar to those of the other stations. The total salt content, hardness, and Ca content were higher. Harm may be done by waters coming from such plants which use solid fuel. The danger comes from the high content of mineral suspended matter, relatively high alkalinity, and high sulfide. Settling in special ponds is recommended. After settling, the pH decreases as well as the sulfide content, but it is not sufficient to satisfy the limits allowed for disposal in surface water. To obtain a maximum pH of 8.5 in the waters coming from the settling ponds, the dilution recommended is 12/1 - 20/1, and for sulfide less than 100/1. (Novotny-Vanderbilt)
W70-02403

MECHANISMS OF SELF-PURIFICATION IN FLOWING WATERS (EDGARDO BALDI MEMORIAL LECTURE) (GERMAN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
O. Jaag.
Verh Internat Verein, Limnol, Vol 14, p 41-58, July 1961.

Descriptors: *Self-purification, *Sedimentation, *Rivers, *Streams, Adsorption, Decomposing organic matter, Carbohydrates, Proteins, Alcohols, Phenols, Aerobic conditions, Bacteria, Aquatic microbiology, Water pollution effects, Aerobic bacteria, Biochemical oxygen demand, Dissolved oxygen, Turbidity, Water quality, Eutrophication, Nitrates, Phosphates.

The description and discussion of processes which are generally called self-purification is presented. The classical definition of pollution is stated and then the decomposition chains of different compounds are described, e.g., the decomposition processes of carbohydrates, organic acids, alcohols and ketones, cellulose, lignin, proteins, etc. The role of microorganisms is discussed and compared with purification processes in the waste water treatment plant. On the basis of new research results it is stated that some algae have a positive influence on the biochemical decomposition rate. Radioactive pollution is separated and looked upon as a particular problem. The self-purification of a radioactive pollutant is primarily the result of physical processes and biological adsorption of radionuclides. Hydraulic conditions (velocity, depth) are very important in determining the saprobic system. A value of minimal oxygen content of 3-4 mg O2/l is recommended. (Novotny-Vanderbilt)
W70-02405

BIBLIOGRAPHY ON THERMAL POLLUTION.
American Society of Civil Engineers, New York. Committee on Thermal Pollution.

Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol 93, No SA3, p 85-113, 1967.

Descriptors: *Bibliographies, *Thermal pollution, *Instrumentation, *Water supply, Aquatic life.

The initial charge of the ASCE Committee on Thermal Pollution of the Sanitary Engineering Division was to investigate and correlate available information regarding the effect, from a sanitary engineering standpoint, of the unnatural increase or decrease of water temperature caused by the industrial use of water. The general categories of the resulting bibliography include (1) general properties of heat and heat exchange between water and atmosphere; (2) effects of heated discharges on the receiving body of water; and (3) effects of heated discharges on uses made of the receiving body of water. Categories (2) and (3) contain the greater number of articles; specifically studies on cooling ponds, water supplies, lakes and reservoirs, rivers and streams, stratified flow problems, mixing and dispersion, instrumentation methods and devices, and effects on aquatic life. The bibliography is in alphabetic order according to author. It is not in any order based on the classifications given above. A total of 879 references are given but no comment is made as to the relevance of any article or how much of the article is related to thermal pollution. Articles are not reviewed or commented upon. (Rietveld-Vanderbilt)
W70-02410

DISSIPATION OF HEAT FROM A THERMALLY LOADED STREAM,
Geological Survey, Washington, D.C.
H. Messinger.
Geological Survey Professional Paper 475-C, p C175-C178, 1963. 3 fig, 3 ref.

Descriptors: *Heat transfer, *Cooling, *Energy budget, Temperature, Streams, Solar radiation, Evaporation, Convection, Thermal powerplants.

An energy-budget analysis of a heated stream failed to account for the observed rapid cooling. Discrepancies between predicted and actual downstream temperatures were attributed primarily to inadequacies in existing methods for measuring the effective solar and atmospheric irradiation of partially shaded water surfaces. The greatest deviation from theory occurred during the daylight hours. These observations give greater weight to the possibility of errors in the net incoming atmospheric and solar radiation terms. Windspeed inaccuracies were not deemed to be important in this case. (Novotny-Vanderbilt)
W70-02414

BACTERIAL RESPONSE TO THE SOIL ENVIRONMENT,
Colorado State Univ., Fort Collins.
J. W. Boyd, T. Yoshida, L. E. Vereen, R. L. Cada, and S. M. Morrison.
Available from the Clearinghouse as PB-188 515, $3.00 in paper copy, $0.65 in microfiche. Sanitary Engineering Paper No 5, June 1969. 22 p, 12 tab, 11 fig, 21 ref. OWRR Project A-001-COLO.

Descriptors: *Soil microbiology, *Bacterial mobility, *Bacterial survival, *Zeta, potential, Microbiology, Groundwater, Water quality.

Studies to elucidate some of the basic mechanisms by which surface pollution may gain entrance to subsurface water supplies were conducted. Measurements of survival of selected bacteria in certain soil types found in Larimer County, in an area northcast of Fort Collins, Colorado, were made. Samples of two soil types were analyzed chemically and the effects of soil moisture, organic matter, chelation agents and soil sterility upon bacterial life were observed. The role of bacterial predators found in soil was determined, as were the roles of selected inorganic and organic compounds and soil extracts upon bacterial nutrition and/or survival. The collected data showed that while moisture and nutritive value of soils were important for bacterial survival, microbial overpopulation was a major cause of bacterial death. Microbial predators existing in these soils had little or no effect on bacterial survival. Further research was initiated to determine the effects of particulate matter and bacterial surface charge on the mobility of bacteria. Data showed that the size of sand granules and the specific type of ion present in bacterial suspensions greatly affected the mobility of bacteria through sand columns. Bacterial surface charges (zeta potential) were determined in water and in the presence of certain ions. Specific ions markedly changed the zeta potential of the bacteria tested. An attempt was made to correlate the zeta potential data with the mobility values obtained with sand columns. The value of a 'Pollution Index' rating for soils was discussed.
W70-02442

5C. Effects of Pollution

EFFECT OF IRRIGATION ON THE CHEMICAL QUALITY OF LOW STREAMFLOW ADJACENT TO CEDAR BLUFF IRRIGATION DISTRICT, KANSAS,
Geological Survey, Lawrence, Kans.
Robert B. Leonard.
Kans State Dep Health Environ Health Serv Bull No 1-10, 1969. 17 p, 6 fig, 6 tab, 5 ref.

Descriptors: *Return flow, *Irrigation water, *Water quality, *Water pollution sources, *Kansas, Base flow, Streamflow, Groundwater movement, Surveys, Data collections, Hydrologic data, Discharge (Water), Hydrologic budget.
Identifiers: Cedar Bluff Irrigation District (Kans).

Groundwater discharge from the expanding Cedar Bluff Irrigation District, Kansas, constituted successively larger proportions of low streamflow measured in the Smoky Hill River during 7 salinity surveys between April 1964 and March 1967. After 1964 the composition of the inflow remained relatively constant, but the concentration of chloride in the irrigation reach progressively increased and the concentration of sulfate decreased in a downstream direction to values higher and lower, respectively, than in the calcium sulfate type irrigation water from Cedar Bluff Reservoir. The changes were caused mainly by variations in the rate and distribution of groundwater discharge from the district in response to fluctuations in the quantity of rainfall and applied irrigation water. (Knapp-USGS)
W70-02093

STUDY OF CHLORINATED PESTICIDES IN OYSTERS AND ESTUARINE ENVIRONMENT OF THE MOBILE BAY AREA,
Gulf Coast Marine Health Sciences Lab.
For primary bibliographic entry see Field 05B.
W70-02100

MANGANESE TOXICITY OF LEGUMES SEEDED IN KENTUCKY STRIP-MINE SPOILS,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
William A. Berg, and Willis G. Vogel.
USDA Forest Serv Res Pap NE-119, 1968. 12 p.

Descriptors: *Manganese, *Phytotoxicity, *Strip mines, *Legumes, *Plant growth, Hydrogen-ion concentration, Vegetation establishment, Black locust trees, Lespedeza, Spoil banks, Kentucky, Reclamation, Revegetation, Acidic soils, Soil chemical properties, Coal mines, Aluminum.
Identifiers: *Acidic spoils, *Manganese toxicity symptoms, *Strip-mine reclamation, Birdsfoot trefoil, Nodulation.

The occurrence of manganese toxicity was studied on six legume species grown in 46 different acid strip-mine spoils from Kentucky. This toxicity was characterized by a distinct chlorosis on the leaf margins that was readily seen on young leaves of all the species except Kobe lespedeza. Spoil pH was useful in predicting Mn toxicity on the legumes; water soluble Mn extracted from the spoils was not. Korean and bicolor lespedeza seedlings were susceptible to Mn toxicity on spoils with pH below the range of 5.0 to 5.5. Sericea lespedeza in the

seedling stage was also susceptible below this pH range, but on some spoils it outgrew the early toxicity symptoms. Kobe lespedeza, birdsfoot trefoil and black locust did not show Mn toxicity symptoms on most spoils with pH above 4.5. (Vogel-Forest Service)
W70-02209

EPIBENTHIC ALGAL PRODUCTION AND COMMUNITY RESPIRATION IN THE SEDIMENTS OF MARION LAKE,
British Columbia Univ., Vancouver. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W70-02244

QUANTITATIVE CATION REQUIREMENTS OF SEVERAL GREEN AND BLUE-GREEN ALGAE,
Wisconsin Univ., Madison. Inst. of Plant Development, and Wisconsin Univ., Madison. Dept. of Botany.
G. C. Gerloff, and K. A. Fishbeck.
Journal of Phycology, Vol 5, No 2, p 109-114, 1969. 3 fig, 3 tab, 23 ref.

Descriptors: *Algae, *Chlorophyta, *Cyanophyta, *Nutrient requirements, Analytical techniques, Water pollution effects, Phytoplankton, Plankton, Aquatic microbiology, Cycling nutrients, Essential nutrients, Calcium, Magnesium, Potassium, Harvesting of algae, Limnology, Nutrients, Physiological ecology, Chlorella, Scenedesmus.
Identifiers: *Cations, Draparnaldia, Draparnaldia plumosa, Stigeoclonium, Microcystis, Stigeoclonium tenue, Microcystis aeruginosa, Nostoc, Nostoc muscorum, Absorption, Spectrometry.

Authors evaluated requirements of six species of green and blue-green algae (Chlorella pyrenoidosa, Scenedesmus quadricauda, Draparnaldia plumosa, Stigeoclonium tenue, Microcystis aeruginosa, Nostoc muscorum) for calcium, magnesium, and potassium in terms of critical cell concentrations (CCC) of the three cations. 'Critical cell concentration' is defined as the minimal cell content of an element which permits maximal or near-maximal growth of an organism. As compared with requirements of angiosperm crop plants, calcium needs of all six species were extremely low (CCC 0.06% or less on oven-dry basis); requirements for magnesium were equal to or slightly less than in agiosperms (0.15-0.30%) with exception of Scenedesmus (0.05%); and requirements for potassium varied greatly, from CCC less than average values established for angiosperms (0.25-0.50%) to values equal to or greater than mean values for higher plants (0.80-2.40%). The results suggest differences in physiology and function of cations in the algae studied and in angiosperms which seem worthy of further investigation. (Fitzgerald-Wis)
W70-02245

AUTECOLOGICAL STUDIES ON THE DOMINANT PHYTOPLANKTON SPECIES OF LAKE CHAMPLAIN,
Vermont Univ., Burlington. Dept. of Botany.
For primary bibliographic entry see Field 02H.
W70-02247

TRISODIUM NITRILOTRIACETATE AND ALGAE,
Ontario Water Resources Commission, Toronto. Div. of Research.
A. E. Christie.
Ontario Water Resources Commission, Div of Research Paper No 2023, June 1969. 11 p, 4 tab, 6 ref.

Descriptors: *Algae, Algal control, Algicides, Aquatic algae, Aquatic microbiology, Bioassay, Chlorophyta, Chlorella, Cycling nutrients, Essential nutrients, Inhibition, Nitrogen compounds, Nutrient requirements, Nutrients, Pollution identification, Sewage, Sewage effluents, Sewage treatment, Water pollution control, Water pollution effects, Water pollution treatment, Detergents, Toxicity, Activated sludge, Eutrophication, Biodegradation, Amino acids.
Identifiers: *Trisodium nitrilotriacetate, NTA, Chlorella pyrenoidosa, Carboxylic acids, Amino carboxylic acids.

Author reports results of preliminary tests to determine the effect of the potential detergent builder, trisodium nitrilotriacetate, on growth of the green alga, Chlorella pyrenoidosa (Ind 395). Increases in nitrogen (N) from 0.14 to 14 milligrams N/liter resulted in threefold increases in cell counts for N either from trisodium nitrilotriacetate or from sodium nitrate. Trisodium nitrilotriacetate in concentration of 275 milligams/liter was not toxic to cultures of Chlorella at an initial concentration of 1 million cells/milliliter. The filtrate of an activated sludge, capable of degrading trisodium nitrilotriacetate, would support the growth of Chlorella. (Fitzgerald-Wis)
W70-02248

DEMONSTRATION OF THE ANTAGONISTIC ACTION OF LARGE AQUATIC PLANTS ON ALGAE AND ROTIFERS,
Wisconsin Univ., Madison. Dept. of Zoology.
Arthur D. Hasler, and Elizabeth Jones.
Ecology, Vol 30, No 3, p 359-364, July 1949. 1 fig, 4 tab, 6 ref.

Descriptors: *Aquatic plants, *Algae, *Rotifers, Plankton, Bass, Phytoplankton, Ponds, Zooplankton, Minnows, Pedalfers, Scenedesmus, Chlamydomonas, Temperature, Carbon dioxide, Hydrogen ion concentration, Biocarbonates, Dissolved oxygen, Detritus, Bacteria, Water pollution effects, Limnology, Cyanophyta.
Identifiers: *Antagonistic action, *Aquatic macrophytes, Anacharis canadensis, Macrophytes, Potamogeton foliosus, Experimental limnology, Brachionus, Synchaeta pectinata, Polyarthra vulgaris, Karatella cohclearis, Asplancha, Lecane, Bosmina, Navicula, Fragilaria, Cyclotella, Flagellates, Ankistrodesmus, Gomphenema, Spirogyra.

Plants and animals vary greatly in density and species composition and are controlled by extremely complex factors. Macrophytes may have certain competitive advantages over algae when their populations attain specific densities. In experiments reported here, authors aimed at evidence confirming or contradicting previous casual observations bearing on such antagonisms. 'Silo ponds' erected within a large hatchery pond, were densely planted with Anacharis canadensis associated slightly with Potamogeton foliosus. During summer, phytoplankters and zooplankters were counted weekly. Zooplankton of all ponds were subject to similar degrees of predation since each contained 50 fingerling largemouth bass. Fathead minnows were maintained in each pond as food for the bass. Dense growths of aquatic macrophytes in the 'silo ponds' had statistically significant inhibiting effect upon phytoplankton and rotifers, whereas planktonic crustacea were not affected. Growth of bass varied so greatly that it precluded determination of effect of aquatic plants on fish growth. Lists of dominant planktonic genera in planted and control (plant-free) ponds are given. Data on temperature, free carbon dioxide, pH, bicarbonate ion, and dissolved oxygen of experimental and control ponds are reported. (Jones-Wis)
W70-02249

THE OVERALL PICTURE OF EUTROPHICATION,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
E. Gus Fruh.
Journal Water Pollution Control Federation, Vol 39, No 9, p 1449-1463, 1967. 1 fig, 7 tab, 66 ref.

Descriptors: *Eutrophication, Lakes, Organic wastes, Oxygen, Standing crop, Algae, Zooplankton, Fish, Bacteria, Benthic fauna, Photosynthesis, Bioassays, Aquatic weeds, Thermal stratification, Epilimnion, Hypolimnion, Cycling nutrients, Taste, Odor, Color, Turbidity, Hydrogen sulfide, Iron, Magnesium, Cooling, Property values, Recreation demand, Irrigation, Trace elements, Nitrogen fixation, Atmosphere, Groundwater, Watersheds (Basins), Runoff, Phosphorus, Nitrogen, Agricultural watersheds, Forests, Waste water (Pollution), Land management, Copper sulfate, Sodium arsenite, Harvesting, Water pollution, Vitamins.
Identifiers: Shoreline vegetation, Stormwater, Drainage.

Nitrogen and phosphorus, important in plant growth, are subject to control and modification. The immediate question which confronts water quality investigators is whether nitrogen and phosphorus are really the limiting factors in particular aquatic environments which they are investigating. Such determinations can be accomplished by various bioassay techniques. In laboratory cultures of algae, trace elements, previously overlooked, are essential. Likewise, different soils have been added to culture media to supply various necessary organics and growth factors. Today, known vitamins and organic compounds are used. Water quality investigators should determine whether such micronutrients are in sufficient supply in the hydrosphere under various ecological conditions. Knowledge of such facts permits a logical approach for identification of primary nutrient sources. Some nutrient sources, including rainfall, groundwater, and normal watershed drainage, cannot be controlled. If wastewater effluents cause eutrophication, diversion or tertiary treatment can be applied. If agricultural and/or urban drainage are primary nutrient sources, little can, for all practical purposes, be accomplished. Possible economic approaches under investigation in lakes are selective withdrawal of hypolimnetic waters, dilution, aeration of the hypolimnion, and mixing of hypolimnetic waters with the epilimnion. (Jones-Wis)
W70-02251

EUTROPHICATION TRENDS IN THE UNITED STATES--A PROBLEM,
California Univ., Berkeley. Sanitary Engineering Research Lab.
William J. Oswald, and C. G. Golueke.
Journal Water Pollution Control Federation, Vol 38, No 6, p 964-975, June 1966. 9 fig, 2 tab, 18 ref.

Descriptors: *Eutrophication, *United States, Watersheds (Basins), Bioassays, Productivity, Population, Watershed management, Input-output analysis, Nutrients, Water quality, Tertiary treatment, Waste disposal, Chara, Activated sludge, Effluents, Trickling filters, Irrigation systems, Farm ponds, Reservoirs, Cyanophyta, Bulrush, Synthesis, Sewage, Agriculture, Fertilizers, Industrial wastes, Nitrogen, Phosphorus, Trace elements, Light intensity, Light quality, Water pollution effects, Temperature, Chlorella, Scenedesmus, Euglena, Biochemical oxygen demand.
Identifiers: *Water pollution trends, Assimilative capacity, Algal growth potential, Pithophora, Decay, Flushing action, Algal incubator, Oscillatoria, Anabaena.

Preparation of a materials balance, based on the assimilative capacity and productivity of the body of water and its watershed, is of value in analyzing eutrophication potential. Many natural systems are in equilibrium, particularly when watersheds are less than 50 times larger than its receiving body. For watersheds which are large and heavily populated, eutrophication is inevitable. In watershed management today, no significant effort has been made to balance inputs and outputs. In the future, outputs must be balanced with inputs, must be dispersed, or nutrient addition controlled. If these alternatives are ignored, we will be compelled to sacrifice our precious bodies of water to a vastly accelerated form of the processes of eutrophication. It is possible, by a simple inexpensive bioassay procedure, to evaluate algal growth potential, and consequent eutrophication potential of a water

sample. Such a test may be valuable in determining the degree of eutrophication of a given body of water and to serve as a comparison of eutrophication potential of receiving waters. It may also serve as a basis for comparing bodies of water. (Jones-Wis)
W70-02253

A PHYTOPLANKTON BLOOM IN WESTERN LAKE ERIE,
Public Health Service, Cleveland, Ohio.
For primary bibliographic entry see Field 02H.
W70-02254

ALGAL GROWTH AND SEWAGE EFFLUENT IN THE POTOMAC ESTUARY,
Johns Hopkins Univ., Baltimore, Md. Dept. of Sanitary Engineering and Water Resources.
For primary bibliographic entry see Field 02L.
W70-02255

FURTHER PLANKTONIC ALGAE OF AUCKLAND SEWAGE TREATMENT PONDS AND OTHER WATERS,
Bolivar Labs., Salisbury (Australia).
A. Haughey.
New Zeal J Marine and Freshwater Res, Vol 3, No 2, p 245-261, June 1969. 17 p, 6 fig, 13 ref.

Descriptors: *Algae, *Plankton, *Sewage, *Sewage treatment, *Eutrophication, Ponds, Pollutant identification, Biology, Water pollution, Water pollution sources, Algal control, Bioindicators.
Identifiers: *New Zealand, Sewage treatment pond algae.

Seventeen species of algae, newly recorded between 1965 and 1968 from sewage treatment ponds around Auckland City, are described together with another 11 species found in eutrophic waters of the area. These latter natural waters are often of a transient nature and usually heavily polluted in some way. (Gabriel-USGS)
W70-02304

EFFECT OF pH ON THE RATE OF BOD OF WASTEWATER,
Maryland Univ., College Park. Dept. of Chemistry; Birla Inst. of Tech. and Science, Pilani (India). Dept. of Civil Engineering; and Roorkee Univ. (India). Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W70-02308

CHARACTERISTICS AND SIGNIFICANCE OF RESISTANCE TO INSECTICIDES IN FISHES,
Mississippi State Univ., State College. Dept. of Zoology.
Denzel E. Ferguson.
Reservoir Fishery Resources Symposium, Athens, Ga., p 531-536, 1968. 12 ref. Grants from the Agricultural Research Service and US Public Health Service.

Descriptors: *Public health, Resistance, Pesticide toxicity, DDT, Fish genetics, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Pesticide residues.
Identifiers: *Pesticide resistant fish, Mississippi Delta region, Gambusia.

Several species of freshwater fishes from cotton-producing areas of the Mississippi Delta region exhibit resistance to a variety of pesticides. The rate at which resistance evolves, the nature of genetic mechanisms responsible for resistance, and the effects of resistant populations upon natural ecosystems pose challenging problems to fishery biologists. Recent findings suggest that toleration of massive amounts of pesticide residues in tissues of resistant fish represents a hazard to potential consumers, including man. (Sjolseth-Wash)
W70-02315

DEGRADATION OF DDT IN ATLANTIC SALMON (SALMO SALAR),
New Brunswick Univ., Federicton. Dept. of Biology.
G. L. Greer, and U. Paim.
J Fish Res Bd, Canada, Vol 25 (11), p 2321-2326, 1968. 1 fig, 21 ref.

Descriptors: *DDT, *Degradation, Atlantic salmon, Chromatography, Pesticide residues, Chlorinated hydrocarbon pesticides, Metabolism, Pesticide toxicity.
Identifiers: DDE, TDE, New Brunswick.

Atlantic salmon were reared in solutions of DDT. After they died, they were analyzed by thin layer chromatography to determine the pesticide residues. In one experiment three groups of salmon were exposed to three different concentrations (2, 0.1 and 0.01 ppm) of p, p-DDT. Three DDT residues corresponding to DDT, DDE, and TDE were separated from the extracts of each of the three groups of parr. The chromatograms indicated that the parr had taken up considerable quantities of DDT from the suspensions and had degraded a substantial proportion of the DDT to DDE and TDE within 9 hours. Another experiment was designed to test the possibility that some DDT, adsorbed on the external surfaces of the parr, might have been degraded before its adsorption by the parr. It was found that DDT adsorbed on external surfaces of the salmon was not degraded. (Sjolseth-Washington)
W70-02341

SIGNIFICANCE OF CHLORINATED HYDROCARBON RESIDUES TO BREEDING PELICANS AND CORMORANTS,
Wisconsin Univ., Madison. Dept. of Wildlife Ecology; and California Univ., Berkeley. Dept. of Nutritional Sciences.
Daniel W. Anderson, Joseph J. Hickey, Robert W. Risebrough, Donald F. Hughes, and Robert E. Christensen.
The Canadian Field-Naturalist, Vol 83, No 2, p 91-112, 1969. 4 fig, 5 tab, 65 ref. Funds from Bu Sport Fish and Wildlife, USFWS, and NSF, GB6362.

Descriptors: *Chlorinated hydrocarbon pesticides, *Bird eggs, *Hatching, Birds, Pesticide residues, Pesticide toxicity, Dieldrin, Inhibitors, Metabolism, DDT, Gas chromatography, Fallout, Wisconsin, Gulls, Fertility, Enzymes, Eggshell thickness.
Identifiers: *Polychlorinated biphenyls, *Reproductive physiology, Pelicans, Cormorants, DDE, TDE, Manitoba, Saskatchewan.

Pelican and cormorant breeding colonies in the prairie states and Manitoba and Saskatchewan were used for pesticide studies. The levels of chlorinated hydrocarbons present in eggs and spring food of Double-crested Cormorants and White Pelicans and the effects the residues might have upon the reproductive physiology of these species. Samples were analyzed by gas chromatography. The highest cormorant egg residues were 45.0 ppm of DDE and 28 ppm of Polychlorinated biphenyls (PCB). The highest DDE residues from pelican eggs ran 4.8 ppm and only trace amounts of PCB. Interspecific differences in residues are discussed. A relationship between PCB and DDE residue levels and eggshell deposition was elucidated. The authors feel that the population status of a given cormorant colony can be related to the residues and thus the shell thickness of eggs from that colony. Declining bird populations, reproductive success, and sublethal effects of chlorinated hydrocarbons are discussed. The physiological effects of chlorinated hydrocarbons relating to eggshell formation are discussed. It is felt that the chlorinated hydrocarbons disrupt enzymes activity and thus affect calcium metabolism. (Sjolseth-Washington)
W70-02342

A REPORT ON THE RELATIVE TOXICITIES AND DISPERSING EVALUATIONS OF ELEVEN OIL-DISPERSING PRODUCTS,
Washington State Water Pollution Control Commission; and Washington State Dept. of Fisheries.
Harry B. Tracey, Ronald A. Lee, Charles E. Woelke, and Gene Sanborn.
Report, Jan 1969. 19 p, 4 tab, 4 ref.

Descriptors: *Bioassay, *Dispersion, *Fish, *Oysters, *Salmon, *Oil, *Toxicity, Oily water, Water pollution, Larvae, Pacific Northwest U.S.
Identifiers: *Dispersants, Steelhead, Hood Canal.

A series of bioassays (using steelhead fingerlings in fresh water, Pacific oyster larvae in saltwater, and coho salmon fingerlings in situ in Hood Canal) and dispersing-evaluation experiments were conducted on 11 oil-dispersants in an attempt to provide applicable information concerning oil-dispersing products to organizations involved in oil spill control in the Pacific Northwest. Group numbers were assigned to each dispersant according to its performance in the toxicity experiments and the dispersing evaluations. In general, dispersants assigned the lower group-number combinations provide the least threat to the aquatic environment and the greatest dispersing efficiency; however, the others may be employed in special cases. (Tyner-Washington)
W70-02343

FISH LOSSES AFTER FOREST SPRAYING WITH INSECTICIDES IN NEW BRUNSWICK, 1952-62, AS SHOWN BY CAGED SPECIMENS AND OTHER OBSERVATIONS,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
C. J. Kerswill.
J Fish Res Bd Canada, Vol 24 (4), p 709-729, 1967. 9 tab, 7 fig, 11 ref.

Descriptors: Atlantic salmon, Brook trout, Insecticides, Fish kills, DDT, Pesticide toxicity.
Identifiers: Forest spraying, Spruce budworm, Malathion, Phosphamidon, Live-box studies, New Brunswick streams.

The survival of young Atlantic salmon and eastern brook trout, held in cages and free-loving was observed in New Brunswick streams inside and outside forested areas sprayed from aircraft with DDT and other insecticides for budworm control. DDT-in-oil in a single application at 1/2 lb/acre caused heavy loss of underyearling salmon and parr within 3 weeks. DDT-in-oil at 1/4 lb/acre had no apparent short-term effects on salmon parr, but killed many underyearlings; two applications 10 days apart were about as harmful as a single application at 1/2 lb/acre. DDD at 1/2 lb/acre and 1/4 lb/acre, and malathion at 1/8 lb/acre, were no more harmful to young salmon than DDT at 1/4 lb/acre. Experimental spraying of phosphamidon-in-water at 1 lb/acre had no apparent harmful effects on young salmon and trout. Observations at a counting fence 12 miles below the lower boundary of the forested area sprayed with DDT at 1/2 lb/acre in 1954 showed extensive killing of suckers and cyprinids. Wild young salmon were found dead in streams when autumn water temperatures approached freezing after June sprayings of watersheds with DDT. (Sjolseth-Washington)
W70-02344

TOLERANCES OF THREE SPECIES OF ANURAN AMPHIBIANS TO FIVE CHLORINATED HYDROCARBON INSECTICIDES,
Mississippi State Univ., State College.
Denzel E. Ferguson, and Caroline Chapman Gilbert.
J Miss Acad Sci, Vol 13, p 134-138, 1967. 1 tab, 5 ref. USPHS Grant ES00086.

Descriptors: *Chlorinated hydrocarbon pesticides, *Pesticide toxicity, Frogs, Bioassays, Toads, DDT, Aldrin, Dieldrin, Lethal limit, Resistance, Tolerance.

Identifiers: Toxaphene, Mediam tolerated limit, Intraspecific tolerance variation, Interspecific tolerance variation.

Bioassays of five insecticides with two species of cricket frogs and Fowler's toads from several localities differing in degree of insecticide contamination showed aldrin and dieldrin to be less toxic than DDT and toxaphene. Anuran populations near treated cotton fields exhibited up to 200-fold resistance compared with populations from pesticide-free areas. Population tolerance appeared to reflect environmental contamination and probably history of exposure. Toads were generally more tolerant than cricket frogs. Intraspecific variation in tolerances between populations from pesticide contaminated areas and from non-agricultural areas exceeded interspecific variation in localities presumed to be comparable in history of pesticide contamination. (Sjolseth-Washington)
W70-02345

EFFECTS OF FLUCTUATIONS OF LEAD, TEMPERATURE, AND DISSOLVED OXYGEN ON THE GROWTH OF BROOK TROUT,
Connecticut Univ., Storrs. Coll. of Agriculture.
D. Dorfman, and W. R. Whitworth.
J Fish Res Bd Canada, Vol 26, No 9, p 2493-2501, 1969. 1 tab, 27 ref. Partially supported by NSF grant 6P-1819. OWRR Project A-003-CONN.

Descriptors: *Brook trout, *Dissolved oxygen, *Temperature, *Water pollution, Fish, Growth rates.
Identifiers: *Lead, Salvelinus fontinalis.

Slug doses of lead at concentrations of 25 mg/liter administered once a day 5 days/week to brook trout, Salvelinus fontinalis, caused a reduction in growth. Slug doses of 15 mg Pb/liter administered once a day 5 days/week had no apparent effect on the growth of the trout; those trout which received 10 mg Pb/liter (slug dose, 5 days/week) were not adversely affected. There were some interactions with temperature and oxygen concentration. (Tyner-Washington)
W70-02346

MASS MORTALITIES AND BEHAVIOR OF BROOK TROUT AND JUVENILE ATLANTIC SALMON IN A STREAM AND JUVENILE ATLANTIC SALMON IN A STREAM POLLUTED BY AGRICULTURAL PESTICIDES,
Fisheries Research Board of Canada, St. Andrews (New Brunswick).
J. W. Saunders.
J Fish Res Bd Canada, Vol 26, p 695-699, 1969. 1 fig, 10 ref.

Descriptors: *Endrin, *Fishkill, Brook trout, Atlantic salmon, Pesticide toxicity, Bioindicators, Fish behavior, Chlorinated hydrocarbon pesticides, Electro-fishing, Electrical resistance, Fish migration, Resistance.
Identifiers: *Nabam, Mill River, Prince Edward Island, Accidental spillage, Cascumpeque Bay, Delayed mortality.

After accidental spillage of the agricultural pesticides nabam and endrin into Mill River, Prince Edward Island, there were extensive mortalities among brook trout and juvenile Atlantic salmon. Above the spillage site a day after the spill, the trout were apparently healthy while no live trout were found in 2 miles below the spillage site. Some pools contained over 300 dead trout 4 days after the spillage. No live trout were seen in 6 miles of the river. Surviving trout and salmon showed abnormal behavior including unseasonal downstream movements in summer and unusual response to an electrical field. When exposed to an electric field in the water, the trout and salmon fell to the stream bottom. The normal response under natural conditions would have been for them to swim to the anode. The pesticides appeared to have no effect upon eels and sticklebacks were more resistant than trout and salmon. The author proposes that the abnormal behavior could provide a useful biological indicator of pollution by the pesticides. (Sjolseth-Washington)
W70-02347

CHANGES IN A STREAM POPULATION OF TROUT ASSOCIATED WITH INCREASED SILT,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
J. W. Saunders, and M. W. Smith.
J Fish Res Bd, Canada, Vol 22 (2), p 395-404, 1965. 2 fig, 1 tab, 19 ref.

Descriptors: *Silts, Brook trout, Standing crop, Steam erosion, Soil erosion, Scour, Turbidity, Fish populations, Soil investigations, Surface funoff, Fish reproduction.
Identifiers: *Fish survival, Fish size, Ellerslie Brook, Prince Edward Island, Measurement of silt, Fish distribution, Siltation recovery.

Streams on Prince Edward Island contain high silt loads after rains. Ellerslie Brook was studied to determine the changes in a trout population and show the association with increased silt. The sources of silt are described. Summer standing crops of brook trout were determined in various stream sections by mark and recapture. A marked change was noted in the distribution of trout after silting. Trout moved away from silted areas into areas free of silt where normally they would not have been found. A summary of the annual summer standing crops of trout is presented. The association of silting with low standing crops was apparent. Decreased standing crops appeared to result from the destruction of hiding places. The upper brook, where silting was not occurring, had an upward population trend during the same period. The relationship between silting and spawning ground damage is discussed. Following scouring, trout stocks soon increased. The remarkable adaptability of trout to silting, in a habitat with favorable flow and water temperature, was illustrated. (Sjolseth-Washington)
W70-02348

SOURCES OF ERROR IN THE USE OF FISH-BRAIN ACETYLOCHOLINESTERASE ACTIVITY AS A MONITOR FOR POLLUTION,
Mississippi State Univ., State College. Dept. of Zoology.
James R. Gibson, J. Larry Ludke, and Denzel E. Ferguson.
Bulletin of Environmental Contamination and Toxicology, Vol 4, No 1, p 17-23, 1969. 1 tab, 1 fig, 8 ref. Grants ES00086-03 and UI00348-01, US Public Health Service.

Descriptors: *Inhibitors, *Inhibition, Organophosphorus pesticides, Fish physiology, Bioassay, Fishkill, Pesticide toxicity, Monitoring.
Identifiers: *Acetylocholinesterase activity, Parathion.

The practicality of using fish brain acetylocholinesterase (AChE) activity as a monitoring method for pollution was examined. Bluefill sunfish were taken from waters with no organophosphorus insecticide contamination and from laboratory waters containing parathion. Various regions of the brain differ in AChE activity, with the inferior lobe the highest and cerebral hemispheres the lowest. Brain AChE activities in 7 groups of bluegills were determined to study effects of prior treatment upon AChE determinations. One group was a control, 5 groups were subjected to different freezing and thawing procedures prior to examination, and one group was analyzed without the inferior lobe. Significant differences in AChE activity were found depending on the form of prior treatment. They suggest therefore that a monitoring method based upon a 10% depression in AChE activity can lead to erroneous conclusions, even under carefully controlled conditions. Mortality and recovery from organophosphorus poisoning are not necessarily related to the degree of AChE inhibition. AChE activity of a species fluctuates with time. The degree of AChE inhibition is not always related to amount of inhibitor or to length of exposure. (Sjolseth-Washington)
W70-02349

INSECTICIDE-RESISTANT FISHES: A POTENTIAL HAZARD TO CONSUMERS,
Mississippi State Univ., State College.
Denzel E. Ferguson, J. Larry Ludke, Mack T. Finley, and George G. Murphy.
J Miss Acad Sci, Vol 13, p 138-140, 1967. 5 ref. Grant ES 00086, U S Public Health Service.

Descriptors: *Pesticide toxicity, *Food chains, Bioassay, Gas chromatography, DDT, Pesticide residues, Endrin, Resistance, Trophic level, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Fishkill, Sunfish, Public health.
Identifiers: *Insecticide resistant fisher, *Insecticide susceptible fishes, Mosquitofish.

This study assessed the acturl and potential hazard of an insecticide resistant population of mosquitofish to large-mouthed bass and green sunfish. When three susceptible large-mouth bass and 14 susceptible green sunfish were fed resistant mosquitofish (about 2 ppm DDT) one bass died after 131 days and sunfish died after 107, 111, and 121 days. The sunfish dying after 107 days had 28.17 ppm DDT. All bass and green sunfish in the control lot fed pesticide free mosquitofish survived. Resistant green sunfish survived after each consumed a live mosquitofish containing 24.93 ppm endrin; susceptible green sunfish died in 15.5 hours. Susceptible green sunfish died 2 hours after consuming live mosquitofish containing 1041.66 ppm endrin. Regurgitation failed to prevent death. The potential hazard of resistant fish to the food chain is described. Biological magnification of insecticides by higher trophic levels is discussed as is the ultimate possible danger to man. (Sjolseth-Washington)
W70-02350

EFFECTS ON WILD YOUNG SALMON OF SPRAYING DDT OVER NEW BRUNSWICK FORESTS,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
P. F. Elson.
J Fish Res Bd, Canada, Vol 24 (4), p 731-767, 1967. 12 fig, 11 tab, 66 ref.

Descriptors: *DDT, *Pesticide toxicity, Atlantic salmon, Spraying, Fishkill, Persistence, *Fish populations, Electro-fishing, Pesticide drift, Growth rates, Fish harvest.
Identifiers: Spruce budworm, New Brunswick, Parr, Underyearlings, Recovery.

Aerial spraying of DDT resulted in fishkills when some of the spray got into drainage systems. Wild young salmon in unsprayed and sprayed streams were assessed for number in each of 3 size groups (underyearlings, small parr, and large parr), abundance expressed as population index= average number per 100 yards of stream. DDT at 1/2 lb/acre produced underyearling populations only 2-10% as abundant as in non-sprayed areas. Small parr were 30% as abundant and large parr 50% as abundant as in the control areas. DDT at 1/4 lb/acre yielded underyearling populations about 50% as abundant as with no spraying; small parr were 80% as abundant and large parr were affected very little. When DDT was applied twice at 1/4 lb/acre each time, it was followed by low numbers of underyearlings similar to those observed with a single application at 1/2 lb/acre. Downstream transport of the DDT extended the harmful effects 30 or more miles below spray zones. Delayed mortality followed for 4 to 6 months. Reductions in numbers of young salmon were followed by declines in the subsequent adult population. (Sjolseth-Washington)
W70-02351

AN EXPLORATION OF PESTICIDES IN A LAKE MICHIGAN ECOSYSTEM,
Wisconsin Univ., Madison. Dept. of Wildlife Management; and Wisconsin Alumni Research Foundation, Madison.
Joseph J. Hickey, J. A. Keith, and Francis B. Coon.
J Appl Ecol, Vol 3 (Suppl), p 141-154, 1966. 10 tab, 28 ref. Supported by Bu Spt Fish and Wildlife and Fish and Wildlife Serv.

Descriptors: *Food chains, *Pesticide residues, Pesticide toxicity, Trophic level, Food pyramids, Bottom sediments, Amphipoda, Gulls, Old squaw duck, DDT, Chlorinated hydrocarbon pesticides.
Identifiers: Green Bay (Wis), Pentoporeia affinis, DDE, TDE.

Organochlorine residues in the Green Bay area of north-west Lake Michigan have been investigated. Analyses have been made of: (1) shallow and deep water mud samples, (2) the amphipod Pontoporeia affinis which is an important food source for fishes, (3) Alewives, Whitefish and Chub, and (4) Old-squaw Ducks, Ring-billed Gulls and Herring Gulls. This preliminary study shows the biological concentration of pesticides previously reported for smaller lakes. In Pontoporeia the concentration factor is about 50 times that of the residue level in mud (DDE increases most), and in fish this factor is increased roughly 10 times more still. Among birds, all of which spent part of their life cycle off Lake Michigan, organochlorine levels were progressively higher in brain, breast and body fat; in Old-squaw Ducks, Ring-billed Gulls and Herring Gulls; and in adult as opposed to younger birds. Body fat averaged 2441 plus or minus 334 ppm of the three compounds in twelve Herring Gulls collected in June and in a seemingly healthy condition. (Sjolseth-Washington)
W70-02353

IN VITRO DEGRADATION OF DDT BY INTESTINAL CONTENTS OF ATLANTIC SALMON (SALMO SALAR),
New Brunswick Univ., Fredericton. Dept. of Biology.
A. D. Cherrington, U. Paim, and O. T. Page.
J Fish Res Bd Canada, Vol 26 p 47-54, 1969. 7 fig, 21 ref. Supported by grants from National Research Council of Canada.

Descriptors: *DDT, *Degradation, Atlantic salmon, Chlorinated hydro carbon pesticide, Anaerobic digestion, Chromatography, Heat treatment.
Identifiers: *Intestinal microorganisms, TDE, DDE, In vitro degradation, Streptomycin.

DDT was added to fresh mid- and hind-gut contents of young hatchery-reared Atlantic salmon to elucidate the conversion of DDT by the alimentary tract contents of Atlantic salmon in vitro. The degradation of DDT at 37 deg C was tested. That the TDE was produced through in vitro degradation of DDT and that salmon gut contents were required for the degradation was inferred from the failure to extract demonstrable amounts of TDE from the DDT-free samples and from controls containing DDT but lacking gut contents. The same experiment was conducted at 10 deg C with similar results. Most of the ability to degrade DDT, attributable to intestinal microflora, was eliminated by streptomycin and by heat-sterilization of the gut contents. The authors suggest that since TDE is less toxic than DDT, the activity of intestinal microorganisms may increase the chances of survival of fish that ingest DDT-contaminated prey. (Sjolseth-Washington)
W70-02354

LONG-TERM TOXICITY BIOASSAY OF OIL REFINERY EFFLUENTS,
Fish and Wildlife Service, Bozeman, Mont. Cooperative Fishery Unit; Montana State Univ., Bozeman; and Oklahoma State Univ., Stillwater. Aquatic Biology Lab.
Richard J. Graham, and Troy C. Dorris.
Water research, Vol 2, p 643-663, 1968. (Contribution No 451 from Zoology Dept Oklahoma State Univ). 11 tab, 3 fig, 25 ref. National Institute of Health Research Grant RG-6407.

Descriptors: *Bioassay, *Oil wastes, Oily water, Phenols, Industrial wastes, Chemical degradation, Hydrogen ion concentration, Lethal limit, Dissolved oxygen, Carbon dioxide, Ammonia, Sulfides.
Identifiers: *Low-toxicity effluents, *High-toxicity effluents, Fathead minnows, Condition index.

The effects of oil refinery effluents on fish, when applied for extended periods under conditions of continuous renewal were determined. Toxicity values obtained from long-term tests were compared with those obtained from routine bioassays and it was found that certain wastes cause chronic toxicity. Wastes from 4 refineries were studied so that differences in refining processes and waste treatment methods could be considered. Bioassays of high-toxicity and low-toxicity effluents were conducted. Surviving fish did not appear to suffer adverse effects in sub-acute concentrations of high-toxicity effluents and their behavior and appearance were the same as the controls. High-toxicity effluents had a decrease in toxicity during storage, owing to decreases in ammonia, phenol, and sulfide. Fish were adversely affected by extended exposure to sub-acute concentrations of effluents with low initial toxicity. The difference between low and high toxicity effluents results from the fact that the high toxicity effluents had not been treated in oxidation ponds as had the initial low toxicity effluents. (Sjolseth-Washington)
W70-02355

FISH-LIFE AND POLLUTION IN THE LOWER THAMES: A REVIEW AND PRELIMINARY REPORT,
British Museum of Natural History, London. Dept. of Zoology.
Alwyne Wheeler.
Biological Conservation, Vol 2, No 1, p 25-30, Oct 1969. 1 tab, 1 fig, 12 ref.

Descriptors: *Water pollution control, *Fish harvest, Commercial fishing, Water pollution sources, Water pollution treatment, Fish barriers, Fishkill.
Identifiers: *Thames River, Fish re-establishment.

Commercial fisheries of considerable economic value existed in the tidal reaches of the River Thames, England, until the middle of the nineteenth century. Increasing pollution from industrial and domestic effluents led to their complete destruction and, in the twentieth century, to the virtual absence of a local fish fauna. Recent measures to control pollution have resulted in a partial chemical restoration of the River. Sampling in the lower Thames, by collecting fish caught on the cooling-water intake screens of five electricity generating stations along the River, has shown that fish are present in considerable numbers again. In the period from 28 September 1967 to 31 October 1968, forty-one species were taken. At the farthest upstream point, the majority of fish caught have been freshwater species, while at the farthest downstream station, with one exception, only marine or euryhaline species have been caught. This, and evidence that migratory fish have penetrated through the worst-polluted reaches into relatively clean water, is taken as an encouraging sign of the re-establishment of the fish fauna in the lower Thames. (Sjolseth-Washington)
W70-02356

PERSISTENCE OF DDT IN CRAYFISH IN A NATURAL ENVIRONMENT,
Maine Univ., Orono.
John B. Dimond, Raymond E. Kadunce, A. Stanley Getchell, and John A. Blease.
Ecology, Vol 49, No 4, p 759-762, 1968. 2 tab, 13 ref.

Descriptors: *DDT, *Persistence, *Crayfish, Pesticide toxicity, Pesticide removal, Pesticide residues, Spraying, Maine, Gas chromatography, Food chains.
Identifiers: DDD, DDE, Spruce budworm, Forest soil residues.

DDT residues were measured by gas chromatography in crayfish collected in streams sprayed a single time but in various past years, in streams sprayed two and three times, and in streams never sprayed, to determine persistence in a natural environment. Residues in the year of treatment ranged from 0.5 to 2.5 ppm. By 2 years after treatment, residues had declined to about 0.1 ppm but remained near this level through 9 years after treatment. Crayfish in unsprayed streams carried uniformly low residues, 0.009-0.014 ppm. Prolonged contamination in crayfish in sprayed watersheds apparently derives from highly persistent soil residues. Ecological significance of these residue levels is discussed. (Sjolseth-Washington)
W70-02357

THE RESISTANCE OF TUBIFICID WORMS TO THREE COMMON POLLUTANTS,
Eastern Illinois Univ., Charleston. Dept. of Zoology.
L. Stephen Whitley.
Hydrobiologia, Vol 32, p 193-205, 1968. 5 tab, 3 fig, 18 ref. Grant WP 00937-02 (National Institute of Health).

Descriptors: *Bioassay, *Tubificids, Heavy metals, Phenols, Hydrogen ion concentration, Resistance, Alkalinity, Mode of action, Respiration.
Identifiers: *Lead, *Zinc, *Sodium pentochlorophenate, Tubifex tubifex, Limnodrilus hoffmeisteri, Median tolerance limits.

Tubificid worms were shown to be quite tolerant to toxic materials such as lead, phenol, and zinc. Their median tolerance limit (Tlm) for pH levels in modified Knop solution were shown to be 5.8 to 9.7. Their Tlm for lead was 49.0 pp, at pH 6.5 and 27.5 at a pH of 8.5. For sodium pentochlorophenate (PCP) the Tlm was found to be 0.31 ppm at pH 7.5, 0.67 ppm at pH 8.6 and 1.4 ppm at pH 9.5. The Tlm determined for zinc was 46.0 ppm at pH 7.5. The interactions of pH and these substances were examined and discussed, and the importance of definition of the solution was shown. The mechanism of toxicity for lead and zinc probably is the mucousmetal complex which precipitates on the body wall blocking the exchange of oxygen and carbon dioxide. The toxic mechanism of PCP is possibly a biochemical interruption of oxidative phosphorylation. In each instance these experiments show tubificids with a quantitative resistance to lead, zinc and phenol greater than similar resistance recorded for various fish species. (Sjolseth-Washington)
W70-02358

EFFECTS OF DICHLOBENIL ON TWO FISH-POND ENVIRONMENTS,
Bureau of Sport Fisheries and Wildlife, Columbia, Mo. Fish-Pesticide Research Lab.
Oliver Cope, Joseph P. McCraren, and Lafayette Eller.
Weed Science, Vol 17, No 2, p 158-165, Apr 1969. 8 fig, 10 tab, 10 ref.

Descriptors: *Dichlobenils, *Bioassay, Aquatic weeds, Animal pathology, Bottom sediments, Persistence, Fish reproduction, Fishkill, Growth rates.
Identifiers: *Histopathology, Bluegills, Denver, Tishomingo, Oklahoma, Residues, Hematocrits.

Pond studies were conducted at Tishomingo, Oklahoma with 2,6-dichlorobenzonitrile (dichlobenil) and at Denver, Colorado to measure chronic effects on fish and other effects on the ecosystem. Decline of the herbicide was rapid at Tishomingo, with only about 3% of the material remaining after 11 days, while at Denver the herbicide took 3 weeks to reach peak concentration in the water and was still measurable in the water after 189 days. Dichlobenil was present in bottom sediments after 312 days at Tishomingo and after 166 days at Denver. Weeds were controlled at both

locations. No immediate mortality was sustained by fish at either locality, but day-to-day mortality was serious at higher concentrations at Tishomingo. Reproduction apparently was affected by higher dichlobenil levels at Tishomingo. Growth of fish was fastest in ponds treated with highest rates of dichlobenil at Tishomingo, and slowest in the untreated ponds. Residues of dichlobenil developed in fish from all ponds. Some pathology was seen in liver, kidney, and pancreas of Tishomingo fish. (Sjolseth-Washington)
W70-02359

AN ECOLOGICAL STUDY OF THE POLYCHAETOUS ANNELIDS ASSOCIATED WITH FOULING MATERIAL IN LOS ANGELES HARBOR WITH SPECIAL REFERENCE TO POLLUTION,
California State Coll., Long Beach. Dept. of Biology.
Robert W. Crippen, and Donald J. Reish.
Bulletin of the Southern California Academy of Sciences, Vol 68, Part 3, p 170-187, July-Sept 1969. 2 tab, 1 fig, 33 ref.

Descriptors: *Annelids, *Bioindicators, On-site data collections, Water analysis, Analytical techniques, Path of pollutants, Dissolved oxygen, Phosphates, Nitrates, Nitrites, Turbidity, Water quality, Water pollution sources.
Identifiers: *Water quality indicators, Polychaetes, Capitella capitata, Los Angeles Harbor, Chlorinity.

A quantitative survey of the polychaetes was made at 28-day intervals from floating docks in Los Angeles Harbor for a 17-month period. Additional data consisted of water temperature, turbidity, chlorinity, dissolved oxygen, phosphates and nitrates--nitrites. Stations were selected according to variations in the degree of pollution. Each station was characterized by at least one unique polychaete. The number of species present at a station decreased as the degree of pollution increased. Capitella capitata comprised an increasing percentage of the total polychaete population from the outer harbor to the inner harbor. Polychaetes were absent from the highly polluted station in the inner harbor. The relationship of the chemical and physical data to the polychaete populations was discussed. (Sjolseth-Washington)
W70-02360

THE EFFECTS OF AN ACUTE DDT EXPOSURE ON THE SPONTANEOUS ELECTRICAL ACTIVITY OF GOLDFISH CEREBELLUM,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
A. E. Aubin, and P. H. Johansen.
Canadian Journal of Zoology, Vol 47, No 2, p 163-166, 1969. 1 fig, 1 tab, 7 ref.

Descriptors: *DDT, Bioassay, Mortality, Equilibrium.
Identifiers: *Electroencephalograph patterns, *Cerebellum, Goldfish, Acute exposure, Recovery.

Electroencephalograph patterns were recorded for control and test goldfish. Goldfish exposed to 1.0 p.p.m. DDT in water for 2.5 hours show a complete loss of balance as well as an increase in the amplitude and a decrease in the frequency of the spontaneous electrical activity of the cerebellum. After 6 hours recovery in uncontaminated water they recover their balance and the cerebellum electrical activity returns to control levels. The results were compared to the results obtained by other researchers and the need for future investigation is emphasized. (Sjolseth-Washington)
W70-02361

CHRONIT ORAL DDT TOXICITY IN JUVENILE COHO AND CHINOOK SALMON,
Bureau of Sport Fisheries and Wildlife, Columbia, Mo. Fish-Pesticide Research Lab.
Donald R. Buhler, Mary E. Rasmusson, and W. E. Shanks.
Toxicology and Applied Pharmacology, Vol 14, p 535-555, 1969. 12 tab, 5 fig, 28 ref.

Descriptors: *DDT, *Bioassay, *Pesticide toxicity, Chinook salmon, Chlorinated hydrocarbon pesticides, Pesticide residues, Degradation, Fish physiology, Gas chromatography, Fish diets.
Identifiers: *Fish histopathology, Coho salmon, Kidney degeneration, Chronic toxicity, Ulceration, p,p'-DDT, Technical DDT

Technical and p,p'-DDT was incorporated into test diets and fed to juvenile chinook and coho salmon for periods as long as 95 days. Pure p,p'DDT was slightly more toxic to young salmon than was the technical DDT mixture. Chinook salmon appeared to be 2-3 times more sensitive to a given concentration of DDT in the diet than were coho salmon. The size of the fish greatly influenced toxicity, smaller younger fish being more susceptible to a given diet than larger older fish. The dose of DDT accumulated within the median survival time ranged from 27-73 mg/kg for chinook salmon and from 56-72 mg/kg for coho salmon. The extrapolated 90-dose LD50 (Hayes, 1967) for young chinook and coho salmon were 0.0275 and 0.064 mg/kg/day, respectively. Liver size decreased on prolonged feeding with DDT, and carcass lipid content was increased. A severe surface ulceration of the nose region appeared in coho salmon fed DDT over long periods. (Sjolseth-Washington)
W70-02362

EFFECT OF HALOGENS ON ALGAE - I. CHLORELLA SOROKINIANA,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
Yehuda Kott, and J. Edlis.
Sponsored by Mekoroth Water Co. Water Research, Vol 3, p 251-256, 1969. 4 fig, 1 tab, 19 ref.

Descriptors: *Halogens, *Algicides, Chlorine, Algal control, Chlorella, Disinfection, Mortality.
Identifiers: *Kill rates, *Bromine, Iodine, Photo reactivity, Algal metabolism.

Bromine within the concentration range of 0.2 to 1.0 mg/l caused a decrease in Chlorella number after 2 - 5 hr contact, after which time regrowth occurred. A second dose of bromine at the time of regrowth brought about total algal kill. Using chlorine at the same concentration had an algistatic effect, while a second introduction of chlorine had no additional effect at all. Using a mixture of chlorine and bromine solutions caused rapid algal death. Results of halogenation in the dark demonstrated the superiority of chlorine under these conditions. It is assumed that photoreactivity of bromine might be the reason for its better algicidal effects in the light. (Sjolseth-Washington)
W70-02363

EFFECT OF HALOGENS ON ALGAE - II. CLADOPHORA SP.,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
Nachum Betzer, and Yehuda Kott.
Sponsored by Mekoroth Water Co. Water Research, Vol 3, p 257-264, 1969. 7 fig, 5 tab, 8 ref.

Descriptors: *Halogens, Algicides, Cytological studies, Chlorine, Copper sulfate, Algal control, Mortality, Chlorophyll, Algae, Bioassay, Viability.
Identifiers: *Cladophora, Bromine, Filamentous algae, Kill rates, Photo reactivity, Cell color, Cell damage.

Halogenation of natural tufts gave no fruitful results. Using isolated filaments of Cladophora sp. showed that halogens cause changes in cell color from green to yellow or even to colorless, very often damage to cell wall. Leaching of cell content also occurred, or contraction of cytoplasm was observed. Using dark field technique it was observed that the normal red fluorescence seen in healthy cells disappeared. Very high concentrations (50 mg/l and over) caused severe deformation of cells. In the absence of a recommended procedure for measuring viability of filamentous algae, one hundred cells were counted in each filament and a bioassay was performed at the end of each experiment. Addition of 5 mg/l of halogens has caused some effect on the algae, while addition of copper sulphate at this concentration showed no effect at all. With higher concentrations of halogens or copper sulphate, cell damage was caused. Ten mg/l chlorine for 2 hr, 10 mg/l bromine for 10 hr or 10 mg/l copper sulphate for 4 days of contact caused complete algal kill. (Sjolseth-Washington)
W70-02364

EFFECT OF HALOGENS ON ALGAE - III. FIELD EXPERIMENT,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
Yehuda Kott.
Water Research, Vol 3, p 265-271, 1969. 1 fig, 1 tab, 5 ref.

Descriptors: *Halogens, *Algicides, *Bactericides, Chlorine, Chlorella, E. Coli, Resistance, Disinfection, Mortality, Bioassay.
Identifiers: *Cladophora, *Planktonic algae, Bromine, Cosmarium cells, Chroococcus cells.

Bromine in a concentration of 1.4 mg/l was injected for 9 hr during eight consecutive nights into the Jordan channel which is part of the National Water Carrier of Israel. Chlorine and bromine were injected for the same time during two nights, to yield a total of 0.4 mg/l residual. After 15 min contact, coliforms and fecal coli counts showed full correlation between disinfection capacity of bromine under these conditions to that achieved in the laboratory. Cosmarium known to be resistant to chlorine, proved to be sensitive to bromine. Choococcus found naturally in the water was shown to be sensitive to bromination. Chlorella, placed into the channel water in dialysing tubes, showed to react as in previous laboratory experiments. The combined use of chlorine and bromine in field experiment confirmed laboratory results in which higher algal and bacterial kill was achieved with mixtures of halogens than with any one of them separately. (Sjolseth-Washington)
W70-02365

THE ACTION OF THE RESIDUAL WATERS OF AN ANTIBIOTIC PLANT ON THE PLANKTON AND BENTHOS OF THE RECEPTOR RIVER (IN ROMANIAN),
Institutul de Medicina si Farmacia, Iasi (Rumania). Catedra de Igiena.
Simona Apostol.
French, German, Russian and English summaries.
Igiena, Vol XIV, No 11, p 663-672, 1965. 3 fig, 20 ref.

Descriptors: *Daphnia, *Benthos, *Toxicity, Zooplankton, Tubificids, Resistance, Water pollution effects, Phytotoxicity.
Identifiers: *Antibiotic toxicity, Bahlui River, Rumania, Cyanophyceae, Chironomidae, Physiological determinations.

Hydrobiologic determinations were carried out in the course of 4 years (1961-1964) studying the plankton and benthos of the Bahlui river at two points, up and down stream of the residual waters of an antibiotic plant. The residual waters containing, besides organic matter, also toxic substances, have a negative influence on the plankton, the most affected being the protozoa and the least sensitive the Cyanophyceae. Accumulation of the organic material at the bottom of the river downstream of the residual waters brings about the development in the benthos of the saprobic organisms - Tubifexes and Chironomidae larvae. Physiologic determinations - the testing of Daphnia confirmed the toxicity of the waters downstream, especially when in shallow water. (Sjolseth-Washington)
W70-02366

INFLUENCE OF CERTAIN TOXIC SUBSTANCES IN WATER ON THE MODIFICATIONS OF OXYGEN CONSUMPTION OF DAPHNIA MAGNA STRAUSS (IN ROMANIAN),
Uniunea Societatilor de Stiinte Medicale Din Republica Socialista Rumania, Bucharest.
Simona Apostol, and Ana Vasiliu.
French, German, Russian and English summaries.
Igiena, Vol XVII, No 10, p 627-636, 1968. 6 fig, 15 ref.

Descriptors: *Oxygen demand, *Daphnia, *Bioassay, Dissolved oxygen, Respiration, Animal behavior, Toxins.
Identifiers: *Saponin, *Butyl acetate, *Dibutox, Storage lakes, Oxygen consumption, Mobility.

The use of sensitive tests for appraising the toxicity of storage lakes was studied. To this end, the oxygen consumption of Daphnia magna Strauss under the influence of certain toxic substances was determined, using the Winkler method for dissolved oxygen at 3, 9, 12, 18 and 24 hours, in different saponin, butyl acetate and Dibutox concentrations. In comparison to the controls, the toxic substances tested produced a marked reduction in oxygen consumption. Changes in the respiratory function were noted even at low toxic concentrations at which the survival tests revealed no nocuous influence; no variations were found in the mobility and behaviour of the organism. The Winkler method, applied to study of the first respiratory phase in Daphnia, gave sensitive and reproducible results, and may be introduced in hygiene investigations for determining toxic effects on water organism. (Sjolseth-Washington)
W70-02367

FOLLOW-UP OF THE OXYGEN CONSUMATION OF DAPHNIA AS INDICATOR OF THE ADAPTATION TO DIFFERENT TOXIC SUBSTANCES (IN ROMANIAN),
Institutul de Medicina si Farmacia, Iasi (Rumania). Catedra de Igiena.
Simona Apostol, and Ana Vasiliu.
French, German, Russian and English summaries.
Revista Medico-Chirurgicala, LXXII, No 3, p 703-710, 1968. 4 fig, 6 ref.

Descriptors: *Daphnia, *Oxygen requirements, Bioassay, Mortality, Phytotoxicity.
Identifiers: *Adaptation, Saponin, Dibutox, Butyl acetate, Oxygen consumption.

Experiments were conducted on the adaptation of Daphnia to different toxic substances under laboratory conditions. The indicator used was oxygen consumption in a group of organisms kept for different intervals in various toxic substances: saponin, dibutox, and butyl acetate, in concentrations in which survival of the Daphnia was of 100%. A tendency of the Daphnia to adaptation to these substances was found, expressed by the proportion of oxygen uptake referred to control values. (Sjolseth-Washington)
W70-02368

THE TOXIC ACTION ON PROTOZOA OF THE SUBSTANCES CONTAINED IN THE RESIDUAL WATERS OF THE ANTIBIOTIC PLANT, IASSY (IN ROMANIAN),
Institutul de Medicina si Farmacia, Iasi (Rumania). Catedra de Igiena.
Simona Apostol.
French, German, Russian and English summaries.
Revista Medico-Chirurgicala, LXIX, No 3, p 665-671, 1965. 2 fig, 19 ref.

Descriptors: *Bioassay, *Protozoa, Water purification, Lethal limit.
Identifiers: *Formol, *Oxalic acid, *Butyl acetate, *Sulfuric acid, Iassy, Rumania, Bodo genus, Antibiotic manufacturing plant.

In view of the extremely important role played by protozoa in the process of purification of residual waters, the action of the toxic substances eliminated in the residual waters of the Antiobiotic Plant of Iassy on protozoa of the Bodo genus was determined by biotests. Study of the lethal action of the toxic substances in dilutions of 1:10 to 1:100,000 during 60 minutes showed that the strongest noxious effect is that exercised by formol (necessitating a dilution of 1:10,000 to 1:100,000 to lose its toxicity), followed in decreasing order by oxalic acid, butyl acetate and sulfuric acid. Under the purification conditions of the plant certain substances are neutralized in the departments, the greatest danger for the protozoa population which purifies the residual waters being butyl acetate, upon which full attention should be centered. (Sjolseth-Washington)
W70-02369

ALGICIDAL EFFECT OF BROMINE AND CHLORINE ON CHLORELLA PYRENOIDOSA,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
Yehuda Kott, Galila Hershkovitz, A. Shemtob, and J. B. Sless.
Applied Microbiology, 14 (1), p 8-11, 1966. 4 tab, 3 fig, 16 ref.

Descriptors: *Bioassay, *Halogens, *Growth rates, *Chlorella, Chlorine, Algicides, Algal control, Disinfection, Mode of action, Mortality, Inhibition, Algae.
Identifiers: Bromine, Bromamine, Chloramine.

Chlorella pyrenoidosa was found to grow rapidly in tap water. Peak growth was reached after 2 to 3 days. Chlorine and bromine, added to such water in concentrations of .18 to .42 ppm, were shown to be effective inhibitors of algal growth. Bromine and bromamine were primarily algicidal, whereas chlorine and chloramines were mainly algistatic. It is assumed that the mechanisms of action of these halogens on Chlorella are not the same. The need to investigate the mode of action of these halogens is stressed. (Sjolseth-Washington)
W70-02370

PESTICIDES AND STREAM INSECTS,
Maine Forest Service; and Conservation Foundation, Washington, D.C.
John Dimond.
Bulletin No. 23, Maine Forest Service and The Conservation Foundation, p 1-21, 1967. 3 fig, 5 tab, 24 ref.

Descriptors: *DDT, Maine, *Pesticide toxicity, Pesticide residues, Mortality, Persistence, Diptera.
Identifiers: *Malathion, *Insect population, Spruce budworm, Aerial spraying, Ephemeropter, Odonata, Plecoptera, Trichoptera, Coleoptera, Neuroptera, Recovery.

A two-part study on the effects of malathion and DDT on stream insects was conducted in Maine. In part I, the effectiveness of malathion in controlling spruce budworm and its effect upon stream insects was studied. No changes in the qualitative population structure of streams were noted. Reductions in numbers of dominant insect groups were less than has been reported for DDT except for caddisflies; no effect on stoneflies was noted. The authors state that if at all possible, malathion should be the choice over DDT in insect control programs. In part II the recovery of insect populations in DDT-sprayed streams was investigated. DDT produces marked reductions in the quality and quantity of invertebrate fauna. Larger streams were more seriously affected than the smaller ones. Repopulation occurred within 3 - 4 years. (Sjolseth-Washington)
W70-02371

THE EFFECTS OF HYPER- AND HYPO-CHLORINITIES ON MEMBERS OF THE WOOD-BORING GENUS LIMNORIA,
California State Coll., Long Beach. Dept. of Biology.
D. J. Reish, and W. M. Hetherington, III.
In: International Journal on Life in Oceans and Coastal Waters, 2 (2), p 137-139, 1969. 2 fig, 18 ref.

Descriptors: Chlorination, Isopods, Bioassay, Resistance, Mortality, Water pollution effects, Salinity.
Identifiers: Hyper-chlorinities, Hypo-chlorinities, Limnoria, Burrow length, Tolerance.

The wood-boring isopods Limnoria lignorum, L. quadripunctata, and L. tripunctata were exposed to hypo- and hyper-chlorinities for a 28-day period. Data were analyzed according to survival rate and average burrow length per day. The 50% level was 6.5, 9.5 and 14.5 o/oo at hypo-chlorinities and 27.5, 32.0 and 21.0 o/oo at hyper-chlorinities for L. lignorum, L. tripunctata, and L. quadripunctata, respectively. The average burrow length per day per animal at all chlorinities was highest for L. tripunctata and lowest for L. quadripunctata, with L. lignorum intermediate. (Sjolseth-Washington)
W70-02372

CHLORINATION AS A MEANS OF CONTROLLING EARTHY ODORS IN RESERVOIRS,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
For primary bibliographic entry see Field 05G.
W70-02373

EFFECTS OF IMPOUNDMENTS ON WATER QUALITY,
Tennessee Valley Authority, Chattanooga. Div. of Health and Safety.
For primary bibliographic entry see Field 02H.
W70-02411

IMPOUNDMENT EFFECT ON WASTE ASSIMILATION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
P. A. Krenkel, E. L. Thackston, and F. L. Parker.
Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol 95, No SA1, p 37-64, Feb 1969. 11 fig, 3 tab, 56 ref.

Descriptors: *Biochemical oxygen demand, *Dissolved oxygen, *Reservoirs, *Thermal stratification, *Waste assimilative capacity, *Water temperature, Degradation, Organic matter, Path of pollutants, Photosynthetic oxygen, Pre-impoundment, Reaeration, Respiration, Soil classifications, Stratified flow, Thermal pollution, Tracers, Waste dilution Waste disposal, Water pollution.

The waste assimilative capacity of streams can be greatly affected by changes in temperature and hydraulic regime caused by impoundment. The increase in depth and decrease in mixing reduce atmospheric oxygenation but provide a more favorable environment for photosynthetic oxygenation. While surface layers remain well aerated, benthal demands and sedimentation of organic material may deoxygenate the lower waters. This effect is accentuated by thermal stratification. The effect of impoundment on all phases of the oxygen balance is considered. References and case studies show that the net effect can be a greatly reduced capacity for waste assimilation. An example calculation also shows that the waste assimilative capacity of a stream below an impoundment is reduced by the peaking action of the hydroelectric plant. (Rietveld-Vanderbilt)
W70-02413

5D. Waste Treatment Processes

SUL-BISUL ION EXCHANGE PROCESS: FIELD EVALUATION ON BRACKISH WATERS,
Elgin International Inc., Ill.
For primary bibliographic entry see Field 03A.
W70-02047

STUDY OF REJECTION OF VARIOUS SOLUTES BY REVERSE OSMOSIS MEMBRANES,
Gulf General Atomic, Inc., San Diego, Calif.
For primary bibliographic entry see Field 03A.

W70-02048

FIELD OPERATION OF A MOBILE REVERSE OSMOSIS PILOT PLANT,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 03A.
W70-02050

WATER RECLAMATION BY REVERSE OSMOSIS,
Melpar, Inc., Falls Church, Va.
John H. Fossum.
Res sponsored by Aerospace Medical Res Lab. Avail from Clearinghouse as AD-692 720, $3.00 in paper copy, $0.65 in microfiche. Aerospace Med Res Lab Rep AMRL-TR-68-190, Wright-Patterson AFB, Ohio, May 1969. 47 p, 2 fig, 8 tab, 9 ref, 3 append. Contract No F33615-67-C-1534, Proj No 6373, Task No 637304, Work Unit No 637304003.

Descriptors: *Water reuse, *Reverse osmosis, Reclaimed water, Recirculated water, Desalination processes, Semipermeable membranes, Membrane processes, Urine, Thermodynamics.
Identifiers: Spacecraft water reclamation.

A Laboratory reverse osmosis system capable of purifying 4 liters of a mixture of 2.4 liters of urine and 1.6 liters of either wash or dehumidification water in a 24-hour period was fabricated by Melpar, Inc. The quantitative rejection of urea by the membranes was found to be the major problem. Urea rejection by complexing urea with various chemicals was investigated but no significant increase was realized. The effect of storage conditions on membrane performance was investigated. A study was made of the annealing of cellulose acetate membranes and attempts were made to develop satisfactory benzyl derivatives of cellulose acetate. A method was developed which permitted a rapid evaluation of membrane performance. A satisfactory membrane was found to result from the precise control of the annealing process. (Knapp-USGS)
W70-02058

BIOCIDAL RUBBER FOR WATER RECLAMATION SYSTEMS,
Goodrich (B. F.) Aerospace and Defense Products Co., Akron, Ohio.
For primary bibliographic entry see Field 03A.
W70-02059

AN INVESTIGATION OF LIGHT-CATALYZED CHLORINE OXIDATION FOR TREATMENT OF WASTEWATER,
Midwest Research Inst., Kansas City, Mo.
Alfred F. Meiners, Elizabeth A. Lawler, Mary E. Whitehead, and John I. Morrison.
Robert A Taft Water Res Center Rep No TWRC-3, Fed Water Pollut Contr Admin Advance Waste Treat Res Lab, Dec 1968. 121 p, 40 fig, 31 tab, 13 ref. FWPCA Contract No 14-12-72.

Descriptors: *Tertiary treatment, *Chlorination, *Chemical reactions, *Ultraviolet radiation, Oxidation, Oxygen demand, Chemical oxygen demand, Organic matter, Nutrients.
Identifiers: Ultraviolet-catalyzed chlorination.

A study was made of the effect of ultraviolet radiation on the rate and extent of chlorine oxidation of organic material in highly nitrified effluents from biological sewage treatment plants. Both oxidation rate and the extent of oxidation by chlorine combined with UV radiation are usually much greater than by chlorine alone. The rate of the catalytic oxidation is dependent upon pH, and rate and efficiency are optimal at pH 5. The average COD decrease at pH 5 was 67% in 5 min, 79% in 10 min and 95% in 15 min. The rate of organic oxidation is not proportional to the chlorine concentration; however, the rate of chlorine consumption is. Large excesses of chlorine do not increase the reaction rate but simply increase the amount of chlorine required to eliminate a given amount of organic matter. The rate and extent of the catalytic organic oxidation at pH 5 are not significantly affected by temperature. Both the rate and extent of catalytic oxidation are substantially reduced by the presence of ammonia in an effluent. Phenol, 2, 4-dinitrophenal, glycine, formic acid, and o-dinitrobenxene are oxidized rapidly and extensively. (Knapp-USGS)
W70-02090

OZONE TREATMENT OF SECONDARY EFFLUENTS FROM WASTE-WATER TREATMENT PLANTS,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
D. Th. A. Huibers, R. McNabney, and A. Halfon.
Rep submitted to fulfill Contract between Fed Water Pollut Contr Admin and Air Reduction Co, Inc. Robert A Taft Water Res Center Rep No TWRC-4, Fed Water Pollut Contr Admin Advance Waste Treat Res Lab, Apr 9, 1969. 62 p, 15 fig, 29 tab, 21 ref. FWPCA Contract No 14-12-114.

Descriptors: *Tertiary treatment, *Ozone, *Oxidation, Chemical reactions, Pilot plants, Oxygen demand, Chemical oxygen demand, Organic matter, Nutrients, Costs.
Identifiers: Ozonation.

Ozone effectively lowers the chemical oxygen demand and total organic carbon content of effluents from wastewater treatment plants. It removes odors and color from water and destroys pathogenic organisms. Tertiary treatment with ozone has the potential of an automated, trouble-free operation with low maintenance. An efficient contacting process and a prelimenary evaluation of its economics were investigated. Ozonation was first studied by low-shear countercurrent contracting in an 18-ft column packed with Raschig rings. Later it was found that the rates of COD and TOC removal could be considerably increased by high-shear contacting using a turbine agitator. The optimum treatment of secondary effluent with ozone required multi-stage cocurrent contacting. A six-stage system was simulated by mixing through the 18-ft packed tower. Overall efficiences as high as 90% were obtained. The estimated treatment cost is 7.7 cents/1000 gal to reduce the COD from 35 mg/l to 15 mg/l assuming an 80% ozone-utilization efficiency in a 10 mgd plant. This is about equal to the estimated cost for treatment with activated carbon. Chemical clarification of the secondary effluent prior to treatment with ozone would reduce ozone consumption and result in a lower final COD and TOC. (Knapp-USGS)
W70-02118

FULL-SCALE OXYGEN TRANSFER STUDIES OF SEVEN DIFFUSER SYSTEMS,
Milwaukee Sewerage Commission, Wis.
Raymond D. Leary, Lawrence A. Ernest, and William J. Katz.
J Water Pollut Contr Federation, Vol 41, No 3, Part 1, p 459-473, Mar 1969. 15 fig, 4 tab, 2 ref.

Descriptors: *Oxygenation, *Activated sludge, *Aeration, Efficiencies, Transfer, Oxygen.
Identifiers: *Diffuser efficiency, *Spiral flow, *Diffusers, Ridge-and-furrow, Longitudinal, Crows foot, Cross flow, Alpha, K-sub L-A, Milwaukee (Wis).

Oxygen transfer tests on seven types of diffuser systems are described, namely; (1) spiral flow (tubes); (2) cross-flow (tubes); (3) ridge-and-furrow; (4) crows foot (plates); (5) modified crows foot; (6) transverse; and (7) longitudinal. The tests were made at Milwaukee's 200 mgd activated sludge plant. The efficiencies showed that a longitudinal system would increase the efficiency over 115 mgd. The spiral flow system in use on East section of the plant. Five parallel rows of porousceramic plates were used to increase the organic removal from the 83% spiral flow to 95%. The increase resulted from more uniform air introduction and lower air loadings per diffuser. (Ledbetter-Texas)
W70-02175

STEEL COMPANY BUILDS FLEXIBLE WASTE-WATER TREATMENT SYSTEM,
Kaiser Engineers, Chicago, Ill.
R. D. Smith
Water Wastes Eng (Industrial), Vol 6, No 3, p B1-B4, Mar 1969. 2 fig, 2 ref.

Descriptors: *Industrial wastes, *Steel, Coagulation, Iron oxides, Clarifiers, Sedimentation, Vacuum drying, Sludge dewatering.
Identifiers: *Hot strip mill, Iron scale, Modular construction, Make-up water, Softening, Vacuum filtration, Clarifiers, Coagulation aid.

Wastewater treatment facility at Armco Steel Corp. Middletown, Ohio, hot strips mill is described. Iron oxide particles in the wastewater are coagulated, settled, and vacuum filtered. The plant has modular construction to give flexibility of operation to the 100,000 gpm clarification facility. Make-up water (4%) is lime softened. One control panel operates the plant with special monitoring emphasis on pH. (Ledbetter-Texas)
W70-02176

TREATMENT AND REUSE OF INDUSTRIAL WASTEWATER,
Public Works, Escondido, Calif; and Hirsch and Koptionak, San Diego, Calif.
John A. Williamson, and Lawrence Hirsch.
Water and Sewage Works (Industrial Wastes Supplement) Vol 116, No 7 p IW/24-IW/26, July 1969. 7 ref.

Descriptors: *Industrial wastes, *Reclamation, Economics, Social values, Planning, Nutrients, Desalination.
Identifiers: *Reuse, Esthetics, Conventional treatment, Chemical quality.

The authors briefly describe why industrial waste treatment and reuse are economically justifiable. The treated effluent may be used to supplement other available water. The treatment capabilities are improving to bring about further possibilities in reuse. (Ledbetter-Texas)
W70-02177

OXIDATION DITCH WORKS WELL IN SUB-ARCTIC CLIMATE,
Alaska Univ., College. Inst. of Water Resources.
Gareth A. Grube, and R. S. Murphy.
Water and Sewage Works, Vol 116, No 7 p 267-271, July 1969. 4 fig, 2 tab, 5 ref.

Descriptors: *Alaska, *Arctic, *Ditches, Oxidation lagoons, Freezing, Cold regions, Operation and maintenance, Design data, Dissolved oxygen, Nitrification, Temperature.
Identifiers: *Sub-Arctic climate, Operating characteristics, Mixed liquor suspended solids, Suspended solids.

A study was conducted of the operating characteristics of an oxidation ditch in a cold region (Alaska). The effluent dissolved oxygen nitrates and suspended solids, temperature, and the mixed liquor suspended solids were monitored during the winter months. The study was complicated by mechanical breakdowns which resulted from flood damage to the machinery the previous August. The conclusions reached are that BOD removal is not affected significantly by cold weather (90% removal), mechanical problems were not caused by the cold, and nitrate formation is inhibited at temperatures less than 12 deg C and that the oxidation ditch is the most economical treatment for the far north of Alaska. (Ledbetter-Texas)
W70-02178

OPERATION AND MAINTENANCE OF MUNICIPAL WASTE TREATMENT PLANTS,
Federal Water Pollution Control Administration, Washington, D.C.

Robert L. Michel, Albert L. Pelmoter, and Ralph C. Palange.
J Water Pollut Contr Federation, Vol 41, No 3, Part 1, p 335-354, Mar 1969. 11 fig, 40 tab, 6 ref.

Descriptors: *Operation and maintenance, *Wastewater treatment, *Municipal wastes, Costs, Cost comparison, Activated sludge, Lagoons, Trickling filters.
Identifiers: *Per capita loadings, *Construction Grants Program, Federal Water Pollution Control Administration.

The operation and maintenance of the Federally-assisted wastewater treatment plants from July 1962 through December 1964 are described. Tables of operating costs, process variables, practices, and other treatment-related parameters are included. The conclusions reached are the following: (a) per capita values of raw BOD, flow, and suspended solids increase geometrically with population a factor of 2 x of those for 50,000 to 100,000 over those for 5000 to 10,000; (b) operating costs of stabilization ponds are 10 to 16% of those for mechanical plants; (c) sludge digestion contributes a high proportion to treatment costs; and (d) costs will rise sharply with more sophisticated treatment. The most frequent problem of operation and maintenance was the by passing of untreated wastewater. Other problems are also discussed. (Ledbetter-Texas)
W70-02180

BIOLOGICAL OXIDATION OF COKE PLANT WEAK AMMONIA LIQUOR,
Bethlehem Steel Corp., Pa. Homer Research Lab.
Paul D. Kostenbader, and John W. Fleckseiner.
J Water Pollut Contr Federation, Vol 41, No 2, Part 1, p 199-207, Feb 1969. 4 fig, 2 tab.

Descriptors: *Biodegradation, *Activated sludge, *Phenol.
Identifiers: *Coke wastes, *Weak ammonia liquor, Bio-oxidation.

A full-scale plant treats the weak ammonia liquor wastes from the coke plant of Bethlehem Steel Corp (Bethlehem, Pa). The activated sludge plant design was based on research with the wastes. The loadings have been light and the efficiencies high in oxidizing the phenols since started in 1962. Concentrations are reduced by 99.9% to less than 0.1 mg/l in 112,000 gpd. In addition, thiocyanates are lowered by 70% and cyanides have been reduced as much as 90%. (Ledbetter-Texas)
W70-02181

COAGULATION OF PULPING WASTES FOR THE REMOVAL OF COLOR,
New York State Dept. of Health, Albany; and Washington Univ., Seattle. Water and Air Resources Program.
Stuart E. Smith, and Russell F. Christman.
J Water Pollut Contr Federation, Vol 41, No 2, Part 1, p 222-232, Feb 1969. 10 fig, 17 ref.

Descriptors: *Coagulation, *Pulpwastes, Sulfite liquors, Softwood, Hardwood, Industrial wastes.
Identifiers: *Color removal, *Kraft, *Jar tests, Dosage, Alum, Ferric chloride, Bulking, Papermills.

Alum and ferric chloride can be used to remove color from kraft pulping wastes. Jar tests showed the optimum dosage of coagulant to be linear with the concentration of color with a removal of 2.6 x 10 to the 5th power color units per equivalent of coagulant. With the wastes used, the dosages were the following: alum, pH 5.3 optimun, 150 mg/l for softwood wastes and 300 mg/l for hardwood wastes; ferric chloride, pH 3.9 optimum, 268 mg/l for softwood wastes. Alum and iron are inefficient in removing color from sulfite wastes because of the sulfonate groups. Coagulation of the raw wastes produced a bulking sludge. (Ledbetter-Texas)
W70-02182

PROPOSED DESIGN CRITERIA FOR WASTEWATER LAGOONS IN ARCTIC AND SUB-ARCTIC REGIONS,
Department of National Health and Welfare, Edmonton (Alberta). Public Health Engineering Div.
Robert N. Dawson, and John W. Grainge.
J Water Pollut Contr Federation, Vol 41, No 2, Part 1, p 237-246, Feb 1969. 8 fig, 6 ref.

Descriptors: *Lagoons, *Arctic, *Design criteria, Biochemical oxygen demand, Retention, Outlets, Waste water treatment.
Identifiers: *Canada, *Construction details, Inlets, Aerated ponds, Primary treatment, Secondary treatment.

Four types of wastewater lagoons in cold regions are described: (1) single-cell long retention; (2) primary, short-retention; (3) secondary, long-retention; and (4) aerated. They evaluate each unit for depth, retention time, BOD loading, shape, liquid level, and other parameters. They conclude that single cell, long-retention lagoons are suitable for small plants, 6 to 8 ft deep, 8 to 12 mos retention and 20 lb BOD/acre-day. Primary, short-retention ponds are suitable for the region with design parameters of depth not more than 25 ft, 2 to 4 day retention, and 6 to 9 lb BOD/day-1000 cu ft. Secondary, long-retention lagoons can use some criteria as single-cell except for inlets. They recommend that aerated lagoons be 10 to 20 ft deep, have 30 day retention, and BOD loading up to 0.6 lb/day-1000 cu ft. Construction details, siting, and other factors are discussed. (Ledbetter-Texas)
W70-02183

DESIGNING WASTEWATER TREATMENT PLANTS FOR SAFETY,
Vrooman (Morrell), Gloversville, N.Y.
Morrell M. Vrooman, Jr.
J Water Pollut Contr Federation, Vol 41, No 3, Part 1, p 474-481, Mar 1969. 5 fig, 5 ref.

Descriptors: *Safety, *Design, *Regulations, Explosions, Design standards.
Identifiers: *Safety features, Fires, Falls, Asphyxiation.

The accident rates in wastewater treatment plants are 6 times the average frequency for 41 industrial groups. Engineers should design out hazards to lower this rate. They would do well to inquire of the plant operators for delineation of some hazards. Good design can prevent falls, asphyxiation, fires, and explosions. Several actions need to be taken, including: (1) supplement the water pollution Control Federation Manual of Practice No. 1, 'Safety in Wastewater Works,' to expand design for safety features - 'Musts' and electives; (2) promote adoption of Federation Manual design safety by state agencies as regulations; and (3) arrange adoption of applicable sections of the Federation Manual by the National Fire Protection Association and other code formulators. (Ledbetter-Texas)
W70-02184

THE PRACTICALITY OF USING ATOMIC RADIATION FOR WASTEWATER TREATMENT,
Division of Isotopes Development (AEC), Washington, D.C.; and Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
D. S. Ballantine, L. A. Miller, D. F. Bishop, and F. A. Rohrman.
J Water Pollut Contr Federation, Vol 41, No 3, Part 1, p 445-458, Mar 1969. 2 fig, 3 tab, 15 ref.

Descriptors: *Sludge treatment, *Radioactivity effects, *Radiation, Disinfection, Stabilization, Costs, Feasibility, Wastewater treatment.
Identifiers: *Ionizing radiation, Refractory pollutants, Destructive oxidation.

Applications of atomic radiations to wastewater treatment are described and the probable costs for such treatments are given. They discuss 4 possible applications; they are as follows: (a) sludge handling and dewatering, (b) destructive oxidation of organics, (c) disinfection, and (d) breakdown of refractory molecules. The radiation sources which were considered are cobalt-60, cesium-137, accelerators, reactor loops, spent fuel elements, and mixed fission products. The estimated treatment costs of $0.13 to $1.58 per 1000 gal are not considered competive for most applications. Sludge beneficiation comes closest to practicality at the present time. (Ledbetter-Texas)
W70-02185

TERTIARY TREATMENT BY MICROSTRAINING,
Cochrane Products Crane Co., King of Prussia, Pa.
E. W. J. Diaper.
Water and Sewage Works, Vol 116, No 6, p 202-207, June 1969. 6 fig, 3 tab, 13 ref.

Descriptors: *Tertiary treatment, *Design data, *Costs, Filters, Stainless steel.
Identifiers: *Microstraining, *Backwash, Filter cloth, Filter runs.

A woven stainless steel cloth around the periphery of a partially submerged drum is used to strain the effluent of waste treatment plants. The drum rotates at a variable speed and the collected mat is backwashed from the top of the drum into a collector. The cloth is available with openings of 60, 35, and 23 microns, but it removes much smaller particles because of the matting. A number of installations are described. The article gives available sizes (to 10 mgd) and costs (installed cost of $24,000 to $45,000 per mgd and operating costs of $2.50 to $4.00 per mg) for microstrainers. (Ledbetter-Texas)
W70-02186

POLLUTION CONTROL BUILT INTO GUAYAMA PETROLEUM COMPLEX,
Phillips Petroleum Co., Bartlesville, Okla.
R. W. Klippel.
Water and Sewage Works (Industrial Wastes Supplement), Vol 116, No 3, p IW/2-IW6, Mar 1969. 8 fig, 1 tab.

Descriptors: *Planning, *Pollution abatement, *Industrial wastes, Domestic wastes.
Identifiers: *Petrochemical wastes, *Guayama, Puerto Rico, Sour water, Boiler blowdown, Ballast water, Storm water.

The Core petrochemical complex and satellite industries has a well-planned pollution prevention program. Each industry pretreats its waste then sends the effluent to a centralized secondary treatment plant. The five sewers for the Core facility are: (1) the oily water, (2) the boiler blowdown, (3) the cooling water, (4) the sanitary, and (5) the storm sewers. The nylon fiber plant required sewers (2), (3), and (4). Sour water is separated and skimmed. Runoff receives similar treatment. Ballast water is stripped of the hydrogen sulfide then put into the oily water sewer. Oily water is separated and put back into the harbor. Boiler blowdown water is settled to remove the suspended minerals. (Ledbetter-Texas)
W70-02187

SURFACE AERATION BY MECHANICAL AGITATION,
Rhode Island Univ., Kingston. Dept. of Civil Engineering.
Calvin P. Poon, and Fan-Maw Lee.
Water and Sewage Works, Vol 116, No 7, p 262-266, July 1969. 5 fig, 6 ref.

Descriptors: *Aeration, *Model studies, Dissolved oxygen, Oxygenation, Mechanical equipment, Submergence, Energy dissipation, Depth.
Identifiers: *Agitation, Reoxygenation, Oxygen absorption coefficient, Stirrer, Size of rotor, Rotor speed, Depth area ratio.

Laboratory model aeration tanks were used to study the factors affecting mechanical oxygenation.

The tanks were baffled to prevent swirling of contents. The factors tested were submergence, rotor speed, depth of water and size of rotor. The top of the rotor blades should be at water level for best results. The oxygenation coefficient K-sub a, increases with rotor speed to the 1.5 power to 100 rpm, then at a faster rate. K-sub a is proportional to depth to the minus 1.2 power. At low speeds K sub a is linearly proportional to the ratio of rotor diameter to tank diameter, but is nonlinear at higher speeds. (Ledbetter-Texas)
W70-02188

AERATION EFFICIENCY OF HOWELL-BUNGER VALVES,
Tennessee Valley Authority, Norris. Engineering Lab.
Rex A. Elder, Marvin N. Smith, and Walter O. Wunderlich.
J Water Pollut Contr Federation, Vol 41, No 4, p 629-639, Apr 1969. 13 fig, 1 tab, 6 ref.

Descriptors: *Aeration, *Oxygenation, *Jets, Efficiencies, Design data, Dissolved oxygen.
Identifiers: *Cone valves, *Howell-Bunger valves, *Nottely Dam, Tennessee Valley Authority.

Field tests of fixed dispersion cone valves (Howell-Bunder Valve) are described. They report aeration efficiencies of at least 80% for discharge velocities over 30 ft/sec under all conditions of test. The influence of jet thickness was negligible. The valve was located at the end of a pipeline and tested by discharging either freely into the air or into a containment structure. The authors label the device as an excellent aerator. (Ledbetter-Texas)
W70-02189

HIGH-LEVEL INACTIVATION OF VIRUSES IN WASTEWATER BY CHLORINATION,
Maine Univ., Orono. Dept. of Civil Engineering.
Thomas L. Lothrop, and Otis J. Sproul.
J Water Pollut Contr Federation, Vol 41, No 4, p 567-575, Apr 1969. 9 fig, 1 tab, 19 ref.

Descriptors: *Chlorination, *Viruses, *Disinfection, Bacteriophage, Wastewater treatment.
Identifiers: *Inactivation, *Contact time, *Dosage, Poliovirus, Chlorine residual, Combined chlorine, Free chlorine.

Disinfection studies on the type 1 poliovirus and the type 2 bacteriophage were conducted. They used chlorine dossages of 10 to 50 mg/l. Combined chlorine residuals of 18 to 24 mg/l inactivated 99.9% of T 2 phage after 30 min contact. Type 1 poliovirus required 30 to 37 mg/l of combined chlorine for 99.9% inactivation with a 30 min contact (33 to 43 mg/l gave 99.99%). Doses of 4 to 6 mg/l free chlorine removed 100% of T 2 phage and 1 mg/l gave 100% removal of T 1 poliovirus. (Ledbetter-Texas)
W70-02190

ECONOMICS OF WASTEWATER TREATMENT,
Texas Univ., Austin; and Engineering Science of Texas, Inc., Austin.
W. W. Eckenfelder, Jr., and Davis L. Ford.
Chem Eng, Vol 76, No 18, p 109-118, Aug 25, 1969. 8 fig, 7 tab, 5 ref.

Descriptors: *Cost comparisons, *Cost analysis, Tertiary treatment, Activated sludge, Lagoons, Trickling filters, Sedimentation, Skimming, Chemical precipitation, Ion exchange, Neutralization, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: *Primary treatment, Aerated lagoons, Anaerobic lagoons, Deep well disposal, Suspended solids, Carbon adsorption.

Wastewater characteristics are described from various types of chemical industries, the types of treatments which are likely to be required, and the costs for such treatment units and plants. The costs are related to the initial and final qualities of the wastewater to be treated and to the size of the plants. Curves are shown for the cost of the various unit processes versus size. An example is worked for a conventional activated sludge plant with a daily flow of 2.5 mgd. (Ledbetter-Texas)
W70-02191

KINETICS OF METHANE FERMENTATION IN ANAEROBIC TREATMENT,
Drexel Inst. of Tech. Philadelphia, Pa.; and Stanford Univ., Calif.
Alonzo W. Lawrence, and Perry L. McCarty.
J Water Pollut Contr Federation, Vol 41, No 2, Part 2, p R1-R17, Feb 1969. 10 fig, 4 tab, 26 ref.

Descriptors: *Fermentation, *Methane, *Anaerobic digestion, Design data, Wastewater kinetics, Temperature.
Identifiers: *Volatile acids, *Acetic acid, *Propionic acid, *Butyric acid, Solids retention time, Generation times.

A laboratory evaluation was made of the rate-limiting step of methane fermentation kinetics. An equation to represent the fermentation rate was developed. They found fluctuations from the 'steady-state' volatile acids concentrations. The generation times, as calculated from the Monod coefficients, were 2.2, and 1.9 days for acetic, propionic, and butyric acids, respectively. At a given solids retention time, a decrease in fermentation temperature caused a decrease in treatment efficiency. (Ledbetter-Texas)
W70-02192

HYPERFILTRATION OF PLANT EFFLUENTS,
Oak Ridge National Lab., Tenn.
H. C. Savage, N. E. Bolton, H. O. Phillips, K. A. Kraus, and J. S. Johnson, Jr.
Water and Sewage Works, Vol 116, No 3, p 102-106, Mar 1969. 3 fig, 1 tab, 9 ref.

Descriptors: *Tertiary treatment, *Chemical oxygen demand, *Bacteria, Membranes, Turbidity, Reverse osmosis, Efficiencies.
Identifiers: *Hyperfiltration, *Crossflow-filtration, Porous tube, Ultrafiltration, Filter aid.

Constituents from feed waters deposit a 'dynamic membrane' on porous ceramic tubes. This membrane will accomplish considerable removal of COD, suspended solids, and bacteria. The results of tests on 3 different waters are reported. The COD in lake water (Fort Loudoun Lake) was reduced about 80% when the water was filtered at a rate of 50 gpd/sq ft under a head of 15 atm, from about 30 mg/l to about 6 mg/l. Similar results were obtained for sewage treatment plant effluent, and sewage which had received primary treatment, the latter with filter aid. A decrease in conductivity may be attributable to removal of colloids rather than salts in solution. Application of these experiments are not known at the present, but additional research is warranted. (Ledbetter-Texas)
W70-02193

TREATMENT OF COMBINED SEWER OVERFLOWS AND SURFACE WATERS AT CLEVELAND, OHIO,
Havens and Emerson, Cleveland, Ohio.
George D. Simpson, and Lamont W. Curtis.
J Water Pollut Contr Federation, Vol 41, No 2, Part 1, p 151-168, Feb 1969. 6 fig, 4 tab, 18 ref.

Descriptors: *Cost comparisons, *Cost analysis, *Stabilization, *Feasibility.
Identifiers: *Combined wastes, *Stabilization-retention basin sewerage separation, Cleveland (Ohio).

A feasibility study was conducted on a 30,000 acre feet (37 million cubic meter) retention-stabilization basin at Cleveland, Ohio. The basin would hold the combined wastes in a partitioned section of Lake Erie for bio-oxidation, sedimentation and disinfection. The area of the basin would be 900 acres and the average depth 34 feet. The oxidation and sedimentation would be carried out in separate sections. The cost for the basin and collection system would be $83.5 million (1968). The cost of this method of treatment would be about 1/3 of that for separation of the sewer system and treatment by conventional methods. (Ledbetter-Texas)
W70-02195

WASTEWATER TREATMENT,
Water Pollution Control Federation, Washington, D.C.
R. L. Bunch, W. O. Pipes, W. C. Boyle, and S. K. Banerji.
J Water Pollut Contr Federation, Vol 41, No 6, p 907-993, June 1969.

Descriptors: *Reviews, *Surveys, *Annual activated sludge, Trickling filters, Lagoons, Stabilization, Detergents, Anaerobic conditions, Sludge treatment, Sludge digestion, Sludge disposal, Disinfection, Water reuse, Storm runoff, Wastewater, Physical control, Chemcontrol.
Identifiers: *Literature review, Biofiltration, Anaerobic processes, Water reclamation.

The literature in water pollution control for the previous years is reviewed. An eleven member committee gives brief comments on articles in different categories of water pollution. The ten categories with numbers of references in parentheses are as follows: Biological Filters (14), Activated Sludge (53), Lagoons and Oxidation Ponds (57), Detergents (40), Anaerobic Processes (47), Sludge Treatment, Disposal and Utilization (116), Disinfection (26), Water Reclamation and Reuse (91), Wastewater and Storm Flow Treatment (12) and Physical and Chemical Methods (117). (Ledbetter-Texas)
W70-02196

PLANNING FOR INDUSTRIAL WASTEWATER TREATMENT,
Hercules, Inc., Wilmington, Del. Environmental Services Div.
B. W. Dickerson.
Water and Sewage Works, Vol 116, No 4, p 154-156, Apr 1969.

Descriptors: *Industrial wastes, *Planning, *Design criteria, Neutralization, Skimming, Biological treatment, Coagulation, Emulsions, Organic wastes.
Identifiers: *Zimmerman process, Reaction rate, Catalytic oxidation.

As a result of new regulations, existing plants need upgrading and additional facilities need to be incorporated in new plants. Wastes can upset the well-balanced ecology of a stream. Industrial wastes can be classified under five headings, namely, insoluble and undissolved substances, acid and alkaline discharges, soluble inorganic salts, oils and tars and soluble organic materials. Planning for economical polution control requires a knowledge of the waste characteristics, the assimilative capacity of the stream, and the methods for treatment. The acid and alkaline wastes may be neutralized by the proper chemicals within given reaction times. Organic materials are usually broken down biologically, but the Zimmerman process or calalytic oxidation are also possible. The insolubles may be settled or floated for separation and the colloids and solubles may be coagulated or precipitated to yield insolubles. (Ledbetter-Texas)
W70-02197

EFFECTS OF INSECTICIDES ON ALGAE,
Ontario Water Resources Commission, Toronto.
A. E. Christie.
Water and Sewage Works, Vol 116, No 5, p 172-176, May 1969. 9 tab, 31 ref.

Descriptors: *Algae, *Toxicity, *Insecticides, Metabolism, Radioactivity techniques, Chlorella, Oxidation lagoons.

Identifiers: *Algae toxicity, Carbon-14, DDT, Malathion, Sevin.

A study was conducted of the toxicity and metabolism of DDT, sevin, malathion to cultures of Chlorella pyrenoidosa and algae from a waste stabilization pond. The insecticides in the appropriate solvents were added to culture flasks of algal medium and the number of algal cells counted after various number of days incubation. Carbon-14 tagged insecticides were used to measure uptake and metabolism of the insecticides by algae. DDT exhibited no toxic properties up to 100 mg/l and was only slightly degraded. Sevin is toxic at concentrations above 0.1 mg/l and is not altered appreciably in acidic media. Malathion alters the makeup of mixed culture but is not persistently inhibitory. (Ledbetter-Texas)
W70-02198

CENTRIFUGATION OF WASTE SLUDGES,
Dorr-Oliver, Inc., Stamford, Conn.
Orris E. Albertson, and Eugene E. Guidi, Jr.
J Water Pollut Contr Federation, Vol 41, No 4, p 607-628, Apr 1969. 22 fig, 7 tab, 8 ref.

Descriptors: *Centrifugation, *Sludge, *Dewatering, Cost comparisons, Design criteria, Flow rates.
Identifiers: *Sludge thickening, Solid bowl centrifuges, Long-bowl centrifuges, Pool volume, Bowl speed, Process variables, Feed rates.

Sludge centrifugation with a description of the principles of the centrifuge are reviewed. Results of tests on the solid bowl process variables of feed rate, particle size and density, feed consistency, temperature and chemical aids are reported. The tests were run at 70 sites throughout the U.S.A. on raw primary and secondary sludges, digested primary and secondary pulp and paper wastes and water softening sludges. The results of the tests indicate that a long-bowl centrifuge can handle all types of sludges and can produce a solids concentration as high as or higher than vacuum filters at costs not exceeding those for vacuum filtration. The use of centrifugation for dewatering sludges will increase because of machine improvements. (Ledbetter-Texas)
W70-02199

AN EVALUATION OF RECENT APPROACHES FOR THE DESIGN OF BIOLOGICAL WASTE TREATMENT,
Oklahoma State Univ., Stillwater. Water Resources Research Center.
Quintin B. Graves.
Available from the Clearinghouse as PB-188 293, $3.00 in paper copy, $0.65 in microfiche. Okla State Univ Water Resources Res Center Rep, 1969. 129 p, 25 fig, 10 tab, 61 ref. OWRR Proj No A-010-OKLA.

Descriptors: *Waste treatment, *Aeration, *Aerobic treatment, *Design criteria, *Equations, Chemical oxygen demand, Biochemical oxygen demand, Sewage treatment, Treatment facilities, Oxidation, Activated sludge, Solids contact process, Biodegradation.
Identifiers: Waste treatment design.

Several recent approaches to design of biological waste treatment systems are evaluated and the equations commonly used for calculating biochemical reactions are summarized and listed. Aerator design, including volume, detention time, air supply, sludge recirculation, and sludge wasting, is given major emphasis. General design criteria are also discussed, and design equations are obtained both empirically and theoretically for use in design and operation of waste treatment plants. (Knapp-USGS)
W70-02234

NON-LINEAR PROGRAMMING AS A METHOD OF DESION OF TREATMENT FACILITIES FOR COMBINED SEWER EFFLUENT,
Stanford Univ., Calif.
Charles A. Kohlhaas.
Stanford Univ Engineer Thesis, Sept 1969.

Descriptors: *Optimization, *Storm drains, *Treatment, *Mathematical models, Numerical Analysis Computer programs.
Identifiers: *Storm Sewage, *Combined sewers, *Non-linear programming, Sensitivity analysis.

Due to the high flows experienced in combined sewer systems, treatment can seldom be provided for the entire volume of combined sewage. This leads to the problem of determining the optimum-partial treatment needed to meet water quality objectives. Non-linear programming is used to determine the optimum combination of primary and secondary treatment to be provided for combined sewer effluent. Water quality requirements limiting floating solids, grit, settleable solids, suspended solids and BOD are considered as constraints against an objective function composed of the cost of preliminary, primary and secondary treatment. The nature of the problem allows a graphical solution. The sensitivity of the solution to a number of input variables is performed. The response of cost to the levels of water quality specified by water quality regulations is also investigated. The graphical solution of the non-linear program gives insight into the nature of objective and constraint functions encountered in water pollution control work. In spite of the very non-linear nature of the constraint functions in a mathematical sense, the plots of such functions proved to be largely linear.
W70-02243

SIMULATION OF OXYGEN UTILIZATION IN STORAGE-TREATMENT PLANT SYSTEM,
Pittsburgh Univ., Pa. Dept. of Forests and Waters.
Jan C. Phillips, Raphael G. Quimpo, and James P. Miller.
UNESCO, The Use of Analog and Digital Computers in Hydrology, p 661-670, 1969. 10 p, 2 fig, 2 tab, 10 ref.

Descriptors: *Simulation analysis, *Oxygen demand, *Waste water treatment, *Optimization, *Analog computers, Streamflow forecasting, Water quality control, Effluents, Benefits, Waste storage, Synthetic hydrology.
Identifiers: Multiple-degree treatment.

A system consisting of a treatment plant allowing multiple-degree treatment, a synthesized streamflow sequence and storage elements capable of withholding treated effluent for optimal release was simulated in an analog computer. The objective of the study was to develop an analog model of waste treatment plant for meeting water quality standards while maximizing net benefits of waste treatment. The system was operated for different concurrent values of parameters in the Streeter-Phelps oxygen utilization equation to determine the most efficient operating policy. Results were found to be representative of the conditions in large streams of normal velocities. Problems of modeling and simulation were discussed. Refinements on the model were suggested. (Thiuri-Cornell)
W70-02259

DYNAMIC OPTIMIZATION FOR INDUSTRIAL WASTE TREATMENT DESIGN,
Weston (Roy F.), Inc., West Chester, Pa.
Chia Shun Shih, and Pa. Krishnan.
J Water Pollut Contr, Vol 41, No 10, p 1787-1802, Oct 1969. 16 p, 8 fig, 12 tab, 10 ref.

Descriptors: *Dynamic programming, *Waste water treatment, *Industrial wastes, *Optimization, *Pulp wastes, Design, Cost analysis, Engineering structures, Efficiencies, Systems analysis.
Identifiers: Multi-stage treatment plant.

The dynamic programming technique was used for the system optimization of an industrial wastewater treatment design. A serial multi-stage system with two point boundary values was utilized. The objective of the optimization was to identify the optimum combinations and efficiencies of various unit processes in a multi-stage treatment plant meeting the ultimate design requirements. The principles of dynamic programming were reviewed briefly. Then, based on the wastewater treatment design principles, the economic optimization scheme for the plant design was formulated with the integration of dynamic programming techniques. A specific case in pulp and paper wastewater treatment was presented for illustration. The cost functions used in th. example were compiled on the basis of process design and engineering evaluations. Further refinement of the procedure developed in the study to make it a standard design approach was encouraged. (Thiuri-Cornell)
W70-02261

AEROBIC TREATMENT OF FRUIT PROCESSING WASTES, A Study of Aerated Lagoon, Activated Sludge and Activated Sludge with Sludge Reaeration in the Treatment of Fruit Cannery Waste,
Snokist Growers, Yakima, Wash.
Larry A. Esvelt.
Available from the Clearinghouse as PB-188 506, $3.00 in paper copy, $0.65 in microfiche. FWPCA Water Pollution Control Research Series, DAST-8, Oct 1969. 135 p, 10 tab, 73 fig, 15 ref, 4 append. FWPCA Program 12060 FAD.

Descriptors: Washington, Industrial wastes, Canneries, *Aerobic treatment, Aeration, Waste treatment, Biochemical oxygen demand, *Activated sludge, Sludge treatment, Oxidation lagoons, Reaeration.
Identifiers: Yakima (Wash), *Cannery wastes, Fruit processing wastes, *Aerated lagoons.

In 1966, it was determined that the Snokist Growers cannery in Yakima, Washington, was in need of further treatment facilities for the cannery waste before the waste could be discharged into the Yakima River. A system of aeration was proposed and a grant sought to aid in construction of facilities and to study the results of the treatment facility following construction. Facility construction proceeded in two stages with addition of an aerated lagoon in 1967 and the addition of additional aeration and clarification facilities in 1968 to complete the treatment system. The treatment system performed more efficiently than initially expected in the original design assumptions, and nearly 99% removal of BOD and COD from the waste stream was accomplished during a major portion of the 1968 processing season. The treatment systems were studied over the two operating seasons, and operated as an aerated lagoon, as an activated sludge treatment system and as activated sludge system but including sludge reaeration. Data was collected on biological substrate assimilation, sludge growth, oxygen uptake and sludge settleability. Constants were obtained from this data. Success of the treatment system is reported and the costs of treatment computed. It is recommended that aerated lagoon treatment be used where 70 percent removal of BOD is desired and suspended solids are permissible in the effluent. Activated sludge treatment is recommended for greater than 90 percent BOD removal and where effluent suspended solids must be minimized.
W70-02284

COOLING WATER CHEMICAL TREATMENTS,
Betz Labs., Inc., Trevose, Pa. Cooling Water Services.
John M. Donohue.
Ind Water Eng (IWE) 1st Annu Air/Water Eng Buyers Guide, p 70, 1969.

Descriptors: *Water treatment, *Cooling water, *Corrosion, *Chemical reactions, *Water reuse, Dissolved oxygen, Pitting (Corrosion), Rusting, Metals, Inhibitors, Silts, Organic matter, Iron oxides, Bacteria, Algae, Fungi, Sulfur compounds, Carbonates.
Identifiers: *Metal corrosion, Cooling water treatment, On-stream desludging.

Corrosion of metals is primarily caused by oxygen that is dissolved in water and then released as the cooling water increases in temperature. The most common types of metal attack are pitting of the metal surface, general wasting away caused by low water pH, and gouging of metal surfaces. Chromate-based treatments are the most effective and widely used of the inhibitors for controlling water-side attack. Cooling water antifoulants are used to prevent deposition of silt, iron oxide, organic matter, and general cooling-water debris. The techniques of on-stream desludging of cooling systems with synthetic polymers have been successfully used in cooling operations. Bacteria, fungi, and algae can interfere with water flow, decrease heat transfer, and accelerate corrosion. Biocides developed and used in cooling systems include organic sulfur compounds, organo-metallics, carbonates, diamines, copper, chlorine, hypochlorites, organic chlorine donors and bromine compounds. (Carstea-USGS)
W70-02294

PRODUCTION, DISPOSAL, AND USE OF WHEY IN VERMONT,
Vermont Univ., Burlington. Dept. of Agricultural Economics; and Vermont Univ., Dept. of Animal and Dairy Science.
For primary bibliographic entry see Field 05E.
W70-02299

CHEMICAL-BIOLOGICAL CONTROL OF NITROGEN AND PHOSPHORUS IN WASTE-WATER EFFLUENT,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Edwin F. Barth, Richard C. Brenner, and Ronald F. Lewis.
J Water Pollut Contr Federation, Vol 40, No 12, p 2040-2054, Dec 1968. 15 p, 4 fig, 7 tab, 25 ref.

Descriptors: *Waste treatment, *Nitrogen, *Phosphorous, *Biological treatment, Sewage effluents, Wastes, Waste water (Pollution), Waste water treatment, Flow, Chemical oxygen demand, Suspended load, Denitrification, Pilot plants, Water quality, Water chemistry.
Identifiers: Chemical waste-processing control, *Nitrogen removal, *Phosphorous removal.

A treatment sequence has been developed which removes approximately 90% of the influent COD, SS, nitrogen, and phosphorus. The modular process consists of high-rate activated sludge, nitrification, and denitrification integrated into a single continuous-flow treatment plant. Each of the three biological unit operations has its own recycle system, so enriched cultures of microorganisms develop. Chemical control is by use of ionic aluminum and methyl alcohol. Data collected on a 185-gpd (700-1/day) pilot plant show removal of 85% COD, 95% SS, 91% nitrogen (all forms), and 92% total phosphorus. (Carstea-USGS)
W70-02310

TECHNICAL ASPECTS OF JOINT WASTE TREATMENT -- MUNICIPAL/INDUSTRIAL,

Warren Litsky, Haim B Gunner, and Ruth Kreplick, Editors. Proc of Inst on Joint Munic and Ind Wastewater Treatment, Framingham, Mass, Mar 5-6, 1969. 187 p, 30 fig, 11 tab, 11 ref.

Descriptors: *Water pollution control, *Waste treatment, *Municipal wastes, *Industrial wastes, *Conferences, Water management (Applied), Model studies, Optimization, Systems analysis, Legislation, Legal aspects, Social aspects, Decision making, Economics, Governments, Planning.
Identifiers: *Industrial-Municipal joint waste treatment.

A conference was held to discuss the technology of joint municipal-industrial waste treatment and water pollution control. Instrumentation, planning, models, and contractual arrangements between industries and municipalities are at an advanced state of development and may be used to solve water quality problems. The topics of discussion include the federal and state roles in pollution control, financial aspects, legal aspects, decision making, treatment technology, research and development, and water management research. (Knapp-USGS)
W70-02319

COOLING TOWER APPLICATIONS IN POWER CYCLE DESIGN,
Burns and Roe, Inc., Oradell, N.J.
A. J. Fiehn.
Journal of the Power Division, Proceedings of ASCE, Vol 95, No Po1, p 55-62, Mar 1969. 5 fig.

Descriptors: *Cooling systems, *Cooling towers, *Cooling water, *Electric power generation.
Identifiers: *Evaporative cooling, Closed circuit, Dry-type, Mechanical draft, Natural draft, Wet-type.

Growth of load centers in semi-arid regions, coupled with the increased cooling demands of large-size modern steam-electric generating units, and with community opposition to the unregulated disposal of waste heat to our natural waterways, prophesies a more widespread application of closed-circuit cooling tower systems. Both wet and dry tower designs, permitting significant reduction in the quantities of power cycle cooling supply, can be expected to gain in popularity despite increased plant investment costs and less favorable operating cycle efficiencies. Details of the wet and dry tower systems utilizing either natural of mechanical draft will determine the relative attractiveness of alternate colsed-circuit tower systems in any particular case. Availability of water supply, size and type of generating unit, i.e. nuclear or fossil fuel, and ambient wet and dry bulb temperatures at the project site have major influences on selection. (Upadhyaya-Vanderbilt)
W70-02396

A COOLING POND PROVES CHEAPER,
Mississippi Power and Light Co., Jackson.
R. W. Braswell.
Electrical World, p 84-85, Nov 30, 1953. 1 fig, 2 tab.

Descriptors: *Cooling pond, *Cooling tower, *Thermal pollution, *Cost comparisons, *Baffles, *Dikes, Evaporation.

An economic study was made during the early design stages of the 210,000 KW outdoor Delta Station near Cleveland, Mississippi. Comparative costs studies indicate that initial construction cost of a cooling pond would be approximately 10% less than the towers. Additional advantages of cooling ponds over cooling towers are that it requires lower maintenance costs and has longer life. Estimates of annual operating expenses indicated a savings of up to 2% in favor of the cooling pond. A divided earth baffle approximately 3,000 feet long and extending out into the pond from the plant side, will provide good utilization of available pond area for evaporative cooling. Slopes were seeded by airplane with rye and bermuda grasses for soil stabilization and prevention of erosion. Maximum forced evaporation from the ponds has been estimated at 9 cfs. Two cfs of seepage losses can be expected. The construction project and cost to date indicate that design studies and estimates were approximately correct. (Upadhyaya-Vanderbilt)
W70-02409

THE PROBLEM OF MAKING WASTE WATER SAFE AND ITS USE IN IRRIGATING LIGHT CHESTNUT SOILS IN THE POVOLZHYE AREA,
Volgograd Agricultural Inst. (USSR).
For primary bibliographic entry see Field 03C.
W70-02424

5E. Ultimate Disposal of Wastes

BEHAVIOR OF XENON 133 GAS AFTER INJECTION UNDERGROUND,
Geological Survey, Idaho Falls, Idaho.
For primary bibliographic entry see Field 05A.
W70-02072

COLLECTION, UNDERWATER STORAGE AND DISPOSAL OF PLEASURECRAFT WASTE, Feasibility of Connecting Sewage Holding Tanks on Board Recreational Watercraft to a Dockside Collection System and Storage in an Underwater Tank.
Underwater Storage, Inc., Washington, D.C.; and Silver, Schwartz, Ltd., Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-02283

PRODUCTION, DISPOSAL, AND USE OF WHEY IN VERMONT,
Vermont Univ., Burlington. Dept. of Agricultural Economics; and Vermont Univ., Dept. of Animal and Dairy Science.
C. Lynn Fife, and Kay M. Nilson.
Vermont Univ Agr Exper Sta Bull 658, Sept 1969. 20 p, 3 fig, 6 tab, 12 ref, 1 append.

Descriptors: *Industrial wastes, *Dairy industry, *Vermont, *Byproducts, *Waste disposal, Costs, Water pollution sources, Water pollution control, Costs, Economics, Fertilizers, Foods, Feeds.
Identifiers: Whey, Cheese industry wastes, Byproduct utilization.

The seventeen Vermont cheese plants produced 337 million pounds of whey in 1967. About 69% was the byproduct of low-acid cheeses and 31% the byproduct of high-acid cheeses. Production varied from 40 million pounds in May to 25 million pounds in December. Whey is probably the largest single source of stream pollution in the state. It accounts for about 85% of all industrial pollution and represents a sewage load equal to the domestic wastes of 145,000 people. As of Jan. 1, 1969, legislation prohibits further stream pollution. Forty percent of the whey in the state finds some economic use either as animal feed or fertilizer. Another 20% is handled as sewage but not dumped directly into streams. Annually the industry pays more than $118,000 (above revenues) to handle whey at an average cost of over 5.7 cents cwt. The cost of drying human-grade whey would range from 2.8 to 4.6 cents per pound of powder.. Assembling whey within 40 miles of 80% of production would cost about 1.5 cents per pound, and assembling the rest of the whey in the state would cost from 3.0 to 4.0 cents per pound. Under current price and cost conditions, a large drying plant is feasible if all whey were made available. (Knapp-USGS)
W70-02299

5F. Water Treatment and Quality Alteration

ECONOMIC EFFECTS OF USING SUBSTANDARD QUALITY WATER IN WEBSTER AND OTHER COMMUNITIES IN SOUTH DAKOTA,
South Dakota State Univ., Brookings. Dept. of Economics.
For primary bibliographic entry see Field 03C.
W70-02051

5G. Water Quality Control

CONTAMINATION OF DRINKING WATER.

R I Gen Laws Ann secs 46-14-1, 46-14-2, 46-14-4 thru 46-14-6 (Supp 1968).

Descriptors: *Rhode Island, *Water pollution control, *Water supply, *Water pollution sources, Consumptive use, Water requirements, Pollution abatement, Lakes, Reservoirs, Ponds, Streams, Public health, Non-consumptive use, Preferences (Water rights), Permits, Administrative agencies, Pollutants, Disposal, Wastes, Legislation, Legal aspects, Water resources, Impaired water quality.

No person shall throw or discharge any sewage, refuse, or other noxious matter into any spring, lake, pond, reservoir, or steam used as a source of water supply for drinking purposes by any political subdivision, institution, or company so as to impair or tend to impair the purity of the water or render it injurious to health. No person shall bathe or wash any animal, clothing, or other article in said waters. Certain irrigational and licensed recreational uses are excepted from this prohibition. The Director of Health may order pollutants which are being discharged into said waters or which are located so that there is danger of pollution to be removed from the premises or he may direct other appropriate steps to be taken to prevent impairment of water quality. The Director may prosecute for all violations of this statute. The Director or other official may seek injunctions against violations of this statute. (Kelly-Florida)
W70-02049

WATER QUALITY STANDARDS SUMMARY.
Federal Water Pollution Control Administration, Helena, Mont.

Fed Water Pollut Contr Admin -- Mont State Water Pollut Contr Counc Coop Rep, Aug 1969. 19 p, 1 fig, 2 tab.

Descriptors: *Water quality act, *Water quality, *Standards, *Montana, Legislation, Water pollution, Water pollution control, Sewage treatment, Interstate, Water utilization.
Identifiers: Montana water quality standards.

During the period of 1958 to 1965 Montana adopted water quality standards for all waters of the State. These standards were reevaluated, modified and strengthened in 1967 under provisions of the Water Quality Act. The State was asked by FWPCA to concur with regard to incorporating as part of their enforceable standards a policy provision to protect existing high quality waters. The approved standards are thus both State and Federal standards, enforceable under the State water pollution control statutes and the Federal Water Pollution Control Act as amended (Section 10). The standards consist of 3 major components: designation of the uses which interstate waters are to serve, specification of narrative and numerical criteria to protect and enhance water quality, and specification of a plan of implementation and enforcement, which includes treatment and control requirements for municipal, industrial, and other wastes discharged to or affecting interstate waters. (Knapp-USGS)
W70-02069

PESTICIDES,
Little (Arthur D.), Inc., Cambridge, Mass.
John Neumeyer, Donald Gibbons, and Harry Trask.
Chem Week, p 37-68, Apr 12, Apr 26, 1969. 64 p.

Descriptors: *Pesticides, Pesticide residues, *Herbicides, Mites, Pest control, Pesticide toxicity, Pesticide removal, Fumigants, Fungicides, Insect control, *Insecticides, Larvicides, Nematocides, Rodenticides, Plant growth regulators, Molluscacides, Biological properties, *Biology, Irrigation operation and maintenance, Agriculture.
Identifiers: Biological sciences, Public Health Service, Department of the Interior, *Department of Agriculture.

Chemical pesticides production has grown rapidly, and forecasts indicate pesticide sales will exceed fertilizer sales by 1975. Several thousand products have been cleared and registered for pesticide use in the U.S., but many are mixtures of 2 or more chemicals or different formulations of the same basic chemical. Approximately 400 important basic ingredients are detailed in a list that gives the product name, producer, chemical name and formula, physical properties, product form, oral toxicity, major use category, and major end-uses. Before a new pesticide is marketed, it must be registered with the U.S. Department of Agriculture and approved by the Food and Drug Administration as to tolerances in or on human food and animal feeds. Other Federal agencies review registrations filed with the USDA when the pesticide products could affect fish and wildlife or human safety. (USBR)
W70-02132

RELATION OF AGRICULTURE TO GROUND-WATER POLLUTION: A REVIEW,
North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 05B.
W70-02161

ABANDONED MINES.

Pa Stat Ann Tit 52, Sec 809 (1966).

Descriptors: *Pennsylvania, *Water pollution, *Coal mine wastes, *Mine drainage, Coal mines, Mine wastes, Legislation, Mine water, Water pollution sources, Streams, Rivers, Regulation, Mining, Pollution abatement, Public health, Water conservation.

It is the duty of each and every owner, operator, or lessee of any abandoned coal mine which is discharging polluted water which flows into any of the streams or rivers of the state, to seal the entries and air shalfts for the purpose of cutting off the supply of air. (Schram-Florida)
W70-02163

ACIDITY AND PLANT-AVAILABLE PHOSPHORUS IN STRATA OVERLYING COAL SEAMS,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04D.
W70-02208

AN EVALUATION OF RECENT APPROACHES FOR THE DESIGN OF BIOLOGICAL WASTE TREATMENT,
Oklahoma State Univ., Stillwater. Water Resources Research Center.
For primary bibliographic entry see Field 05D.
W70-02234

A SYMPOSIUM ON WATER QUALITY CRITERIA TO PROTECT AQUATIC LIFE, PRESENTED AT 96th ANNUAL MEETING KANSAS CITY, MISSOURI, SEPTEMBER 1966.

Available from the American Fisheries Soc. Suite 1040, Washington Bldg, 15th St and New York Ave NW Wash, DC, 20005 for $1.25. American Fisheries Society Special Publication No 4, 1967. 37 p, 14 fig, 83 ref.

Descriptors: *Conferences, *Reviews, *Bioassays, *Dissolved oxygen, *Pesticides, *Water quality, *Water temperature, Aquatic life, Fish populations, Water pollution control, Water pollution effects, Physiological ecology, Toxicity, Legislation, History.
Identifiers: *Symposia, Water quality criteria, Industrial growth.

Recent changes in philosophy and law have broadened the scope of water pollution control from primary considerations of human health to those for the protection of all aquatic life. This publication consists of five articles concerned with acceptable concentrations of pesticides, use of bioassays in pollution research, dissolved oxygen criteria for fish protection, and water temperature criteria for protection of aquatic life. Articles are primarily reviews, with data presented on industrial growth, historical growth of pollution problems, and physiology of aquatic organisms. Attention is paid to definition of terms involved in research in water quality and toxicity. A foreword presents a brief history of water quality legislation, and the symposium is summarized in the final article. (Voigtlander-Wis)
W70-02246

COMMENTS ON 'WATER POLLUTION CONTROL USING BY-PASS PIPING' BY A. W. GRAVES, G. B. HATFIELD, AND A. WHINSTON,
Johns Hopkins Univ., Baltimore, Md.
David H. Marks.
Water Resources Res, Vol 5, No 5, p 1159-1163, Oct 1969. 5 p, 3 tab, 12 ref.

Descriptors: *Water pollution control, *Bypasses, *Pipelines, *Waste water treatment, *Technical feasibility, Dissolved oxygen, Cost allocation, Taxes, Damages, Model studies.

An evaluation of a paper by Graves, et. al., was presented. It concerned the mathematical formulation and solution technique for a problem of using by-pass piping of wastes from more polluted to less polluted areas. Some technical problems were found to originate from the authors' attempts to ranslate the assumptions they had made in modelling and formulating, from the waste treatment alternative model on which they were based, to the by-pass piping problem, which has similar form but different technical underpinning. Another technical issue arose from the use of dissolved oxygen as the only measure of quality in the piping problem. The taxation method suggested by the author for determining how the cost of the solution should be allocated was found to raise a question of quantifying damages and thus establishing levels for charges. Economic research and interpretation was encouraged in the particular area of cost allocation. (Thiuri-Cornell)
W70-02257

REPORT ON DEVELOPMENT OF A MATHEMATICAL MODEL FOR MINIMIZING CONSTRUCTION COSTS IN WATER POLLUTION CONTROL.
Camp, Dresser and McKee, Boston, Mass.

Camp, Dresser and McKee, Boston, Mass, June 1969, 207 p, 32 fig, 25 tab, 21 ref, 8 append.

Descriptors: *Mathematical models, *Water pollution control, *Construction costs, *Drainage systems, *Simulation analysis, Cost-benefit analysis, Optimization, Computers, Water quality control, River flow.
Identifiers: Mixed interger programming.

A method was developed for the determination of a least cost construction program to achieve water pollution control objectives within a drainage basin. The method was to accomplish four specific purposes; (a) to minimize the overall costs based on cost of treatment plants; (b) to provide a method for determining the minimum cost for achieving intermediate goals; (c) to develop a means of determining what water quality improvements could be expected from the expenditure of stated limited funds; and (d) to develop a method which would provide the State and Federal Agencies with clearly defined alternative programs. Simulation programs and a mixed integer programming mathematical model were employed for optimizing purposes. Two independent computer programs were developed which together determined the minimum combination of treatment plants to achieve specified quality standards along the main stem of a river. The Merrimack-Pemigewassett River was selected for the demon-

strative of the usefulness of the proposed method of analysis in a real situation. (Thiuri-Cornell)
W70-02258

SHELLFISH GROUNDS AND PACKING HOUSES.
For primary bibliographic entry see Field 06E.
W70-02268

A SYSTEM MODEL FOR STREAM POLLUTION MANAGEMENT,
Arizona Univ., Tucson.
Richard Arthur Norling.
M S Thesis, Dept Syst Eng, Univ Arizona, 1969. 86 p, 1 fig, 19 ref, 5 append.

Descriptors: *Systems analysis, *Mathematical models, *Water pollution control, Stream improvement, Dissolved oxygen, Water management (Applied), Standards.

The philosophy and methodology of systems engineering were applied to the complex problem of stream pollution management and the problem of modeling for stream pollution control was examined. A particular criterion of pollution, dissolved oxygen was chosen and a general model was developed in terms of this criterion. The model was programmed and the results discussed. Because of an inability to find valid data for the dynamic case, sample input functions were generated based on Liebman's data (1965) and the results verified manually. The system model that was presented allowed for multiple criteria and transient condition in the stream. A case was made for the use of modeling in terms of general systems theory independent of the pollution criterion used. (Thiuri-Cornell)
W70-02270

COLLECTION, UNDERWATER STORAGE AND DISPOSAL OF PLEASURECRAFT WASTE, Feasibility of Connecting Sewage Holding Tanks on Board Recreational Watercraft to a Dockside Collection System and Storage in an Underwater Tank.
Underwater Storage, Inc., Washington, D.C.; and Silver, Schwartz, Ltd., Washington, D.C.

Available from the Clearinghouse as PB-188 505, $3.00 in paper copy, $0.65 in microfiche. FWPCA Water Pollution Control Research Series, DAST-10, Sept 1969. 75 p, 6 tab, 17 fig, 7 ref.

Descriptors: *Underground storage, Marinas, *Waste storage, Waste disposal, Boats.
Identifiers: Pleasurecraft, Boat holding tanks, *Sewerage collection, *Underwater storage, Pump-out stations.

A pilot plant was designed, constructed and operated to show the feasibility of providing a facility for the collection, storage and disposal of waste from recreational watercraft. An on-board holding tank was installed in each of ten boats for total impoundment of all effluent and for the connection to a dockside sewage collection system through a quick-connect coupling. Each boat was provided with a pump, tank and macerator. At dockside, each boat holding tank was pumped directly into a piped collection system. The dockside collection system was installed with a flexible hose connector at each slip for attachment to the respective boat. The collection system was installed for gravity flow to an underwater storage tank fabricated of synthetic rubber, impregnated with nylon fibers and fastened to the river bed by a system of patented anchors. The underwater storage tank received and held the effluent for periodic discharged by an on-shore pump station to sewage trucks for delivery to a sewage plant. Flow meters were installed at the marina for recording waste flow to the underwater storage tank and amount extracted from the tank. Samples of waste material entering and leaving the underwater storage tank were taken for laboratory analysis. The project demonstrated that on-board storage of watercraft waste and subsequent discharge to an underwater storage tank was effective and economical. This project showed that the discharge of sewage from boats into rivers, lakes, waterways and estuaries could be eliminated.
W70-02283

AEROBIC TREATMENT OF FRUIT PROCESSING WASTES, A Study of Aerated Lagoon, Activated Sludge and Activated Sludge with Sludge Reaeration in the Treatment of Fruit Cannery Waste,
Snokist Growers, Yakima, Wash.
For primary bibliographic entry see Field 05D.
W70-02284

PROJECTS OF THE INDUSTRIAL POLLUTION CONTROL BRANCH (FEDERAL WATER POLLUTION CONTROL ADMINISTRATION),
Federal Water Pollution Control Administration, Washington, D.C.
William J. Lacy.
Available from the Clearinghouse as PB-188 507, $3.00 in paper copy, $0.65 in microfiche. FWPCA Water Pollution Control Research Report, Aug 1969. 167 p, 9 tab, 4 fig. FWPCA Program 12000.

Descriptors: *Industrial water, *Water pollution control, Wastewater treatment, *Water reuse, *Water pollution treatment, Industries water, Quality water requirement.
Identifiers: Industrial pollution control.

The objective of the industrial pollution control R and D program is to develop and demonstrate the required technology to achieve required degrees of pollution control by lease cost methods for all significant industrial sources of pollution. This report includes summaries of 141 research, development, and demonstration efforts necessary to resolve industrial pollution problems. A total of 1200 program efforts are listed in tabular presentation. These projects include the latest developments in physical, chemical, biological, and combinations of treatment methods. It is expected to develop further the cooperation of industry to participate in meaningful pollution abatement demonstrations and to increasingly demonstrate the feasibility of in-plant measures, by-product recovery, and wastewater reuse as methods to abate pollution and to reduce treatment costs. Research through in-house efforts and by contracts to industries and universities are to complete state of the art studies related to treatment and control technology for selected industry groups. Research through in-house efforts and by contracts to industries and universities are to complete state of the art studies related to treatment and control technology for selected industry groups. Industrial wastewaters are to be identified, characterized, quantitized, and classified for all industries of pollutional significance.
W70-02285

CENTRIFUGES REDUCE WATER POLLUTION,
Pennsalt Chemicals Corp., Philadelphia, Pa. Equipment Div.
J. R. Townsend.
Ind Water Eng (IWE) 1st Annu Air/Water Eng Buyers Guild, p 66, 1969.

Descriptors: *Water pollution control, *Centrifugation, Water pollution, Sewage effluents, Industrial wastes, Sludge treatment, Suspended load, Sedimentation, Cost analysis, Cost-benefit analysis, Economic efficiency, Economic justification.
Identifiers: Waste water solids removal.

Centrifuges are used to reduce water contamination by removing the suspended waste particles from effluents of paper, meat rendering, plastics or other chemical processing plants. The type of centrifuge used depends upon the effluent composition, the degree of clarity desired and the amount to be handled. The following types of centrifuges are briefly described: Basket-type, perforated-wall, disc centrifuge, and solid-bowl continuous-discharge machines. The comparison of various centrifuges with regard to cost and efficiency should include: original equipment cost, cost of money, period of assumed amortization, capacity of the centrifuge, cost of power, installation cost, plant space, manhours required to clean the centrifuge, and personnel costs. (Carstea-USGS)
W70-02295

SURFACE AERATION,
Permutit Co., Paramus, N.J. Pollution Control Applications.
E. D. Driscoll.
Ind Water Eng (IWE) 1st Annu Air/Water Eng Buyers Guide, p 47, 1969.

Descriptors: *Aeration, *Oxygen, *Waste water (Pollution), Biological treatment, Activated sludge, Sludge digestion, Equations, Mixing, Suspended load, Waste treatment, Temperature.
Identifiers: *Surface aeration, Surface aerators.

Atmospheric oxygen can be added to water or waste water by using surface aerators. These devices are often used in biological waste treatment systems, activated sludge systems, aerated lagoons, and aerobic sludge digestion. The purpose of aeration is to furnish the necessary oxygen, maintain the biological solids in suspension, and produce the necessary thorough mixing of oxygen, waste water, and biological solids. Surface aeration is the most efficient technique currently available for introducing oxygen, and the transfer efficiency depends on temperature, oxygen concentration in the system, and characteristics of the waste. An equation for calculating the amount of oxygen transferred at any conditions other than 'standard' is given. (Carstea-USGS)
W70-02296

WATER MANAGEMENT - A NEW WAY OF LIFE,
Dravo Corp., Pittsburgh, Pa. Dept. of Water and Waste Treatment.
E. Stuart Savage.
Ind Water Eng (IWE) 1st Annu Air/Water Eng Buyers Guide, p 36-37, 1969. 2 p.

Descriptors: *Water management (Applied), *Waste treatment, *Industrial wastes, Water sources, Water supply, Water treatment, Water conservation, Water reuse, Water control, Industrial water.
Identifiers: Industrial water management.

The problems of water management, particularly in the field of industrial waste treatment and control, are many. Industry currently accounts for half of the total water use in the United States and this is expected to increase to 65% by 1980. Industry discharges twice as much waste into waterways as municipalities. Very briefly, water management does the following: (1) develops a water source; (2) treats water for use; (3) considers water conservation, recirculation and reuse; and (4) treats wastes and reclaims usable water. Basically, water management consists of planning, organization, implementation, control. All these factors should be given equal consideration in a good water management program. (Carstea-USGS)
W70-02297

WATER QUALITY MANAGEMENT AND THE TIME PROFILE OF BENEFITS AND COSTS,
Water Resources Engineers, Inc., Walnut Creek, Calif.; and Washington Univ., Seattle.
Denny S. Parker, and James A. Crutchfield.
Water Resources Res, Vol 4, No 2, p 233-246, Apr 1968. 14 p, 9 fig, 1 tab, 6 ref.

Descriptors: *Water quality control, *Water quality, *Water management (Applied), *Economics, *Cost-benefit analysis, Water pollution control, Water demand, Planning, Water resources, Water pollution, Water conservation.

Identifiers: Time profile of benefits, Time profile of costs.

Economists, in evaluating the long-term benefits in public works projects, have traditionally held that long-term benefits will contribute very little to the total present worth of the benefits accrued over the life of the project. It is shown, however, that the long-term social cost resulting from projects that cause water pollution cannot be neglected or assumed away in the host of practical cases where 'amenity' demands for good water quality in a project's area of influence are significant. (Carstea-USGS)
W70-02311

INJECTION OF GAS INTO THE LITHOSPHERE AT THE NATIONAL REACTOR TESTING STATION.
Idaho Operations Office (AEC), Idaho Falls. Health Services Lab.
For primary bibliographic entry see Field 05B.
W70-02321

CHLORINATION AS A MEANS OF CONTROLLING EARTHY ODORS IN RESERVOIRS,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
M. Rebhun, M. A. Fox, and J. B. Sless.
The Jerusalem Conference for Water Quality Research, p 1-8, 1969. 5 fig, 10 ref.

Descriptors: *Odor-producing algae, *Taste-producing algae, Algae, Chlorination, Water quality control.
Identifiers: *Oscillatoria, National Water Carrier (Israel), Threshold odor numbers.

Seasonal appearance of blue-green algae (Oscillatoria spp) produces earthy odors and tastes in the water of the Tsalmon and Beth Natufa reservoirs of the National Water Carrier. Field trials, in which water from these reservoirs was chlorinated, showed that chlorination was not completely effective as a means of controlling the earthy odor, although a reduction of the odor level was always observed, when the earthy odor was the sole odor present in the water. A model system employing a species of Oscillatoria, was used to provide samples of water having different levels of threshold odor, and the effect of chlorination investigated. It was found that chlorination reduced the initial odor to an asymptotic value which proved to be directly proportional to the initial odor level. They concluded that complete control of the earthy odor produced by Oscillatoria is not feasible by use of chlorine alone, but that odor levels may be reduced by chlorination to an extent where other methods (such as dilution) are more readily applicable. (Sjolseth-Washington)
W70-02373

COMBINED SEWER SEPARATION USING PRESSURE SEWERS.
American Society of Civil Engineers, New York.

Available from the Clearinghouse as PB-188 511, $3.00 in paper copy, $0.65 in microfiche. Department of the Interior, Federal Water Pollution Control Administration, Wash, DC, Oct 1969. 198 p, 22 tab, 52 fig, 95 ref. FWPCA Program No 11020 EKO, Contract No 14-12-29.

Descriptors: *Pressure conduits, *Sewers, *Flow separation, *Pollution abatement, *Waste water disposal, *Pumping, Sewage disposal, Pumping plants, Pipeline, Separation techniques, Hydraulic conduits, Drainage systems, Storm drains, Storm runoff.
Identifiers: *Sewer separation, Sewer-in sewer, *Waste grinders.

A new concept for separating wastewater from stormwater drainage in combined sewer systems was investigated and reported. Separation is desirable to abate pollution of basements and streams from sewage backups and overflows during periods of heavy stormwater flow. Twenty-five technical reports and memoranda evolving from this project, together with field testing of the concept, constitute the background for the report. The concept involves pulverizing and pumping sewage from buildings through pressure tubing threaded through building sewer lines. These, in turn, connect with pressure conduits inserted within existing street sewers designed to carry both wastewater and stormwater to interceptor sewers. The feasibility of the concept was confirmed and most of the required equipment and materials are available. Pressure conduit can be installed inside street sewers large enough to accommodate workmen. The costs of constructing, operating and maintaining flow-separation systems as envisioned are estimated to be substantially greater than costs of constructing separate wastewater sewer systems. Other applications of the concept, involving the transportation of wastes in pressure tubes and conduits within utility tunnels, may be of greater practical use than that of separating wastewater from stormwater. (Poertner-Chicago)
W70-02392

CONTROL OF TEMPERATURE THROUGH STREAMFLOW REGULATION,
Tennessee Valley Authority, Chattanooga.
M. A. Churchill.
Symposium on Streamflow Regulations for Quality Control, US Public Health Service, Cincinnati, Ohio, Apr 3-5, 1963. Mss 21 p, 8 fig.

Descriptors: *Temperature control, *Reservoirs, *Tennessee River, Tennessee Valley Authority Project, Temperature, *Thermal stratification, Thermocline, *Thermal pollution, Density currents, Density stratification, Cooling, Cooling water, Reservoir operation, Impoundments, Hypolimnion, Epilimnion.

The effect on downstream temperature below a reservoir because of water release from low-level outlets or high-level outlets is discussed. If water is released through low-level outlets significant effects during the warmer months can result. Conversely, if water is released through high-level outlets, the reservoir may have little effect on water temperature. Thermal stratification occurs in a reservoir during the warmer months and density currents can be observed. A beneficial use of density underflows is for cooling of waters for steam condensing purposes in large steam-electric powerplants. Data are presented, observed in, and downstream from, certain impoundments operated by TVA. The data were collected over a period of approximately 26 years. (Novotny-Vanderbilt)
W70-02407

THE PROSPECTS OF UTILIZATION OF THERMAL WATERS (THE MAKHACHKALA CONFERENCE) (RUSSIAN),
For primary bibliographic entry see Field 03C.
W70-02419

UTILIZATION OF SOIL MOISTURE AND GROUNDWATER BY COTTON PLANTS IN THE CASE OF SALINE GROUNDWATER,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
O. G. Grammaticati, and Z. D. Polikarpova.
International Congress of Soil Science, 9th, Adelaide, Australia, Transactions, Vol 1, p 465-472, 1968. 1 tab, 4 fig, 4 ref.

Descriptors: *Arid lands, *Alkalinity, *Soil water, *Groundwater, *Mulching, Cotton, Lysimeters, Sierozems, Irrigated land, Soil chemical properties, Crop production, Chlorides, Sodium, Saline water.
Identifiers: *Uzbeck SSR, *USSR.

Under arid conditions, even when irrigation is employed, plants may utilize fresh groundwater which is sufficiently near the surface. As the salt content of such water rises, plants have greater difficulty in using such water and at some point it becomes impossible. The authors report a lysimeter experiment with cotton plants conducted in the Uzbeck SSR on meadow sierozem soils. Polyethylene film was used as a mulch to retard the rise of salts through evaporation into upper soil layers. Fresh groundwater was used as a control and mineralized groundwater in the other lysimeters had 20 grams/liter of salts. The mulch successfully prevented the salt movement in the soil and salt accumulation in the surface layers. Surface chloride content in the mulched plots was one-seventh that of the unmulched plots. The average yield of cotton in the mulched plots was substantially higher than in the unmulched and was essentially equal to the yield from the fresh water control. (Crouse-Arizona)
W70-02432

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

WATER RESOURCES SYSTEMS ANALYSIS--AN OVERVIEW,
Battelle Memorial Inst., Columbus, Ohio.
Neil L. Drobny.
Fourth Amer Water Resour Conf, Proc Ser No 6, Amer Water Resour Ass, p 534-558, 1969. 25 p, 3 fig, 1 tab, 45 ref.

Descriptors: *Operations research, *Optimization, *Systems analysis, *Mathematical models, *Water management (Applied), Water resources, Water resources development, Planning, Decision making, Optimum design, Simulation analysis, Linear programming, Dynamic programming, Queueing theory, Markov processes, Bibliographies.
Identifiers: Water resources engineering, Water resources management, Deterministic model, Stochastic models.

Mathematical modeling techniques and applications to the design and analysis of water resources systems are explained. The discussion concentrates on basic concepts and features of water resources systems amenable to study by mathematical methods. Mathematical details are avoided and emphasis is placed on model structure. A comparison is made of the general classes of mathematical models: (1) performance vs optimization models; (2) deterministic vs stochastic models; and (3) analytical vs simulation models. The categories are not mutually exclusive. Specific techniques are explained and sample applications given. Optimization methods include linear programming, quadratic programming, and dynamic programming. Stochastic modeling is discussed in regard to statistical decision theory, queueing theory, inventory theory, and Markov processes. Simulation models are discussed. (USBR)
W70-02151

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
M. J. Burley, and J. A. Cole.
UNESCO, The Use of Analog and Digital Computers in Hydrology, p 584-590, 1969. 5 p, 4 fig, 1 tab, 11 ref.

Descriptors: *Reservoir operation, *Water resources, *Multiple-purpose reservoirs, *Hydrologic aspects, *Dynamic programming, *Digital computers, Optimization, Impoundments, Desolination, Economic feasibility, Operating costs.
Identifiers: Linked water resources.

The efficient employment of linked water resources was discussed. The study viewed the subject of linked water resources from two main aspects: (a) the computational problem of operat-

ing two linked storages optimally for any given hydrology, given capacities and fixed economic parameters of operation, (b) the conjunctive use of a desalination plant and surface water impoundment, at a given deficit risk. The objective of the study was to formulate an optimal rule which would be used to guide the operation of linked reservoirs and make the best use of different hydrological and economic characteristics of each component of the linked system to ensure efficient employment of linked water resources. Two examples, one for each of the main aspects of linked water resources were discussed. A dynamic programming approach and a search method were employed for finding the minimum operating cost combination of reservoir contents and preceeding inflows and for deciding at what reservoir contents the desolation plant should begin to operate. A digital computer facilitated the formulation of month by month control rules. (Thiuri-Cornell)
W70-02256

SIMULATION OF THE HYDROLOGIC-ECONOMIC FLOW SYSTEM,
Utah Water Research Lab., Logan.
Murland R. Packer, J. Paul Riley, and Eugene K. Israelsen.
UNESCO, The Use of Analog and Digital Computers in Hydrology, Vol 2, p 386-391, 1969. 6 p, 4 fig, 7 ref.

Descriptors: *Simulation analysis, *Hydrologic properties, *Economic efficiency, *Resource allocation, *Water management (Applied), Optimization, Analog computers, Model studies, Benefits, Water values.

Detailed optimum use considerations in terms of economic efficiency in water resource planning and management using the simulation technique were presented. The Cache Valley, Utah was chosen for simulation in the study. Simulation of an actual hydrologic-economic system synthesized fundamental hydrologic and economic processes into a working model. Water values were investigated by directing water to various alternative uses from a particular phase of agriculture. The resulting change in net benefits both to the system as a whole and to individual sectors of the economy were observed. The analog computer was used to develop a model of the system and to examine the related parameters and the effect of management changes. (Thiuri-Cornell)
W70-02264

MAKING ANALYTICAL TOOLS IN WATER RESOURCES MANAGEMENT USABLE,
TRW Systems Group, San Bernardino, Calif.
M. L. Frankel, and J. A. Beaver.
UNESCO, The Use of Analog and Digital Computers in Hydrology, p 431-438, 1969. 8 p, 1 fig, 4 ref.

Descriptors: *Water resources development, *Resource allocation, *Analytical techniques, *Simulation analysis, *Mathematical models, Operations research, Systems analysis, Cost-benefit analysis, Planning, Water managment (Applied).

The use of operations research techniques for water management was discussed. A classification scheme was described in the study whereby the specific conditions and problems of a region can be related to the existing body of analytical tools; computer simulation and mathematical programming. In order for the planners and managers to derive maximum benefit, the study identified the classification of analytical tools and the management study organization in terms which related readily to the problems of regional resource management. Simulation merely enabled the observation of a system under a particular operating strategy. Mathematical programming techniques were widely used in static and dynamic resource allocation problems. The use of the techniques was aimed at the allocation of limited resources while maximizing benefits or minimizing costs. The management of water resources in the San Bernardino Valley was reviewed as an example. (Thiuri-Cornell)
W70-02265

SIMULATION/OPTIMIZATION TECHNIQUES FOR MULTI-BASIN WATER RESOURCE PLANNING,
Water Resources Engineers, Inc., Walnut Creek, Calif.; and Texas Water Development Board, Austin.
Donald E. Evenson, and Joe C. Moseley.
Rep, Nat Sci Found Short Course Water Resources, N Mex State Univ, Las Cruces, June 1969. 17 p, 3 fig, 1 tab, 8 ref.

Descriptors: *Simulation analysis, *Optimization, *Multiple-purpose projects, *Water resources development, *Planning, Routing, Mathematical models, Hydraulic properties, Network design, Systems analysis.
Identifiers: Stage Development Model.

A set of simulation and optimization tools capable of analyzing the development and operation of a complex, multi-basin, interconnected water resource were explained. Three basin models were developed: (a) a simulation procedure, employing a direct solution of a set of linear equations and an optimization program were used to describe the hydraulic behavior and to compute incurred costs; (b) a network flow code, the Out-of-Kilter Algorithm was used in an optimization model to determine the best reservoir operating rules and the least cost flow routing; and (c) a Stage Development Model incorporated response surface exploration using random sampling and the method of successive perturbation to select the development plan for having the least overall present value. These models provided valuable information regarding the questions: (a) 'When should new projects be built'; (b) 'How big should they be'; and (c) 'How should the system be operated'. These tools were tested on the Texas Water System in order to assure their applicability to the real-world problems. (Thiuri-Cornell)
W70-02266

PROGRESS REPORT ON A DYNAMIC MODEL OF THE ECONOMY OF THE SUSQUEHANNA RIVER BASIN,
Battelle Memorial Inst., Columbus, Ohio.
H. R. Hamilton, S. E. Goldston, D. C. Sweet, N. M. Kamrany, and R. D. Schultz.
Susquehanna River Basin Utility Group, Battelle Memorial Inst, Columbus, Nov 1964. 34 p, 10 fig, 10 tab, 12 append.

Descriptors: *Dynamic programming, *Mathematical models, *River Basins, *Economic feasibility, *Simulation analysis, Constraints, Economic production, Computers, Growth rates.

The report outlined the progress made in the Phase II of the overall research effort toward the development of a dynamic, mathematical model of the economy of the Susquehanna River Basin. Phase I had investigated the feasibility of building a dynamic model. Phase II was directed primarily toward analyzing and tying together factors judged to have significant impact on the growth of the economy of the Basin. The dynamic model was adopted for computer simulation and used to make projections of the economy of the Study Area until the year 2010. To estimate the economic input of constructing alternative sets of river works in the Basin, a 'Moderate' and an 'Elaborate' set of works were hypothesized and the economic consequences simulated by the model. It was concluded that water was not a constraint upon the growth of the economy of the Susquehanna River Basin. (Thiuri-Cornell)
W70-02272

A DISTRIBUTED LINEAR REPRESENTATION OF SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-02286

STOCHASTIC PROCESS OF PRECIPITATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02B.
W70-02298

MESHING WATERSHED DEVELOPMENT WITH RIVER BASIN DEVELOPMENT,
Colorado Univ., Boulder.
Ayers Brinser.
In: Economics of Watershed Planning, p 70-83, Iowa State University Press, Ames, 1961. 14 p.

Descriptors: *Watersheds, *River basin development, Water management, Water resources development, Economics, Planning.
Identifiers: *Watershed development, Basin development.

The problem of adjusting watershed development to river basin development can be greatly reduced by the continued refinement of the tools for measuring the input-output relationships in water resource management. These in turn will help to reduce the area of uncertainty and support investment decisions. To be useful, however, in developing an optimum basin program, the economic data have to be fitted into a planning process that will relate predictable economic consequences to political and social values. This assumes that the optimum is an emerging objective that is approached by contingent solutions sufficiently flexible to respond to change. Programs for river basin development are still in their formative stage. The fact that each basin has its own range of possibilities suggests that there may be no one program for such development. For these reasons, a close scrutiny of going watershed programs that are in early stages of basin development may provide a useful insight into the essential planning process by which water resource management may be guided toward social objectives as time and circumstances define them. (See W70-02374). (Loeb-Rutgers)
W70-02379

PROGRAMMING STRUCTURES IN WATERSHED DEVELOPMENT,
Oregon State Coll., Corvallis.
Emery N. Castle.
Economics of Watershed Planning, p 167-178, Iowa State University Press, Ames, 1961. 12 p, 3 fig, 6 tab.

Descriptors: Watersheds, Linear programming, Computers, Water utilization, Costs, Irrigation, Benefits, Risks.
Identifiers: *Programming, *Watershed development, Activity analysis, Capacity.

Activity analysis or linear programming is suggested as a promising aid in watershed planning in view of the large number of interdependent variables that may be involved. This paper is a progress report on research that uses activity analysis to help solve watershed planning problems. In the problems presented, the number of variables has been limited to permit a better comprehension of the approach. The capacity of computers is such that the number of variables may not be a major obstacle, once problems are formulated adequately. Even if activity analysis does not lead to better projects directly, there may be a substantial indirect benefit. The method provides a framework through which economics and engineering can be integrated. In view of the interdisciplinary aspect of water research, this additional benefit is considerable. (See W70-02374). (Loeb-Rutgers)
W70-02383

THE TIMESCALE OF ECONOMIC MODELS: HOW LONG IS THE LONG RUN,
St. John's Coll., Cambridge (England).
A. B. Alkinson.

The Review of Economic Studies Vol XXXVI, No 106, p 137-152, Apr 1969. 16 p, 16 ref.

Descriptors: *Model studies, *Capital, Equilibrium, Technology, Economic analysis, Mathematical studies, Labor, Income, Prices, Costs, Profits, Population.
Identifiers: *Timescale, *Cyclical growth, Factor shares, Elasticity of substitution, Depreciation, Capital-output ratio.

The author is interested in showing how an analysis of the timescale of economic models may provide valuable additional information. Three different models of economic growth are examined. The first is that of a one-sector economy where there is non-neutral technical progress. In such an economy, one of the factor shares tends asymptotically to zero and the author examines the time path of this movement. A model with heterogeneous capital is examined in an attempt to throw some additional light on current problems. A model of cyclical growth is examined as well as the period of growth cycles generated by this model. Considerable use is made of numerical methods of analysis, in particular in solving differential equations. The widespread use of economic models in the water resource area make an understanding of the timescale vital to the water resource planner. (Murphy-Rutgers)
W70-02385

LECTURES ON THE MATHEMATICAL METHOD IN ANALYTICAL ECONOMICS,
Jacob T. Schwartz.
New York, Gordon and Breach, 1961. 282 p.

Descriptors: *Mathematical models, *Leontief models, Mathematical studies, Analytical techniques, Economics, Prices, Statistics.
Identifiers: *Mathematical method, *Analytical economics, Business cycles, Consumption, Say's Law, Keynesian economics, Multiplier, Liquidity preference, Neoclassical equilibrium, Walrasian equilibrium, Propensity to consume, Matrices.

This volume is composed of a series of lectures in mathematical economics. The author has attempted to put economics in the foreground and mathematics and mathematical rigor in the background. The volume begins with the Leontief input-output model which develops as a general framework for all that is to follow. After an introductory treatment of price theory in the Leontief model the author continues with a discussion of business cycle theory, and develops the connection between cycle theory and the equilibrium analysis that is commonly called Keynesian. The author concludes with a critique of the 'general equilibrium' approach of Walras, attempting to bring notions of Walras and Keynes to an unbiased confrontation. Of particular interest to the water researcher is the first part of this volume dealing with input-output analysis. These models have recently been applied to water area problems in the western states. For example, see the study of H. Craig Davis, Economic Evaluation of Water, Part V, Multiregional Input-Output Techniques and Western Water Resources Development, Contrib. 125, Univ. California, Feb 1968. (For abstract see SWRA, Vol 1, No 9, (Sept 1968), p 112). (Loeb-Rutgers)
W70-02390

A SPECIAL CASE, THERMAL DIGITAL SIMULATION OF WASTE HEAT DISCHARGES,
Battelle-Northwest, Richland, Wash.
For primary bibliographic entry see Field 05B.
W70-02398

6B. Evaluation Process

REPORT ON FOURTH ANNUAL WATER RESOURCES RESEARCH CONFERENCE SPONSORED BY OWRR.
For primary bibliographic entry see Field 09D.
W70-02043

VALUATION OF A GROUNDWATER SUPPLY FOR MANAGEMENT AND DEVELOPMENT,
Nevada Univ., Reno. Desert Research Inst.
P. A. Domenico.
Desert Res Inst Tech Rep Ser H-W, Publication No 3, Nev Univ, 1968. 46 p, 8 fig, 38 ref. OWRR Proj No A-014-NEV.

Descriptors: *Water resources development, *Water demand, *Economic efficiency, *Value, Benefits, Costs, Water rights, Planning, Productivity, Cost analysis, Groundwater, Groundwater basins, Safe yield, Water values.
Identifiers: Water valuation, Groundwater management.

An attempt was made to analyze problems of groundwater management and development in terms of valuation of a resource or property that represents a source of future money receipts. An analytical expression is derived which gives both present worth of gains forthcoming from resource exploitation over a variable time period and the remaining worth of a groundwater supply after it has been partially depleted. With water-level position selected as the denominator common to both the system and its economic worth, a course of exploitation is charted so that (1) present worth of future returns is maximized, and (2) water rights are protected to the extent that water levels are not lowered below the economic limit of pumping. The results enable a conceptual valuation of (1) decision rules for efficiency in management, (2) optimal mining yield for specified conditions, and (3) the state of development of the resource at any time. (Knapp-USGS)
W70-02110

PUBLIC POLICY ISSUES IN WEATHER MODIFICATION,
California Univ., Santa Barbara.
Dean E. Mann.
Proc Amer Soc Civ Eng, J Irrig Drain Div, Vol 95, No IR3, p 375-384, Sept 1969. 10 p, 15 ref, append.

Descriptors: *Weather modification, *Policy matters, Public relations, Public opinion, Cloud seeding, Regulation, Insurance, Legislation, Legal aspects, Financing, Federal budgets, Bibliographies, State governments, Administration, Supervision, Damages, Control, Biological communities.
Identifiers: Public affairs, Regulations, International relations, Federal agencies.

Weather modification is a relatively new technique of environmental control promising important benefits but threatening significant disbenefits. As such, it is a proper subject for public regulation. Because experimentation and action programs are desirable, the imposition of controls should be carefully planned and phased to promote careful experimentation and protect ecological values. Public regulation is principally a state responsibility, but Federal involvement will be necessary and desirable. Federal and state governments must regulate to prevent contamination of projects and prevent projects from interfering with each other. Licensing and setting of scientific qualifications for researchers and practitioners are necessary, probably at state level. Projects of appropriate size must be undertaken to maximize scientific results while not endangering biological communities. Several Federal agencies are involved in weather modification; appropriate roles and missions must be assigned each. An appropriate administrative mechanism must be found for regulating weather modification. Serious questions of indemnification and international relations remain unanswered. (USBR)
W70-02129

COMPREHENSIVE PLANNING: IS IT SUFFICIENT,
Bureau of Reclamation, Denver, Colo.
B. P. Bellport, and H. P. Dugan.
Fourth Amer Water Resource Conf, Proc Ser No 6, Amer Water Resour Ass, p 175-183, 1969. 9 p, 3 ref.

Descriptors: *Planning, *Water Resources development, Policy matters, Project planning, Irrigation, Water resources, Foods, Economics, Water resources planning act, Ecology, Economic efficiency, Social values, Crops, Agriculture, Urbanization, Urban areas, Social needs.
Identifiers: Substitutes, Food supplies, Economic growth, Water resources management.

Comprehensive river basin planning being carried out under the Water Resources Planning Act of 1965 will provide a valuable test of our ability to meet the future requirements for food and fiber needed to maintain a prosperous Nation. Meeting these requirements does not represent the main goal of water resource development, but merely a minimum constraint. Other important social and economic goals may be identified under the overriding mandate to enhance the well-being of the people--regional growth, provision of economic opportunity, stabilization of communities, and provision of a satisfying human environment. Quantitative measures of these developmental or opportunity goals are needed in addition to present measures of economic efficiency. A comprehensive analysis of means to achieve these goals should recognize alternative water management schemes and alternative approaches such as transportation improvement, business stimulation, and provision of increased educational opportunities in economically lagging areas. Many urban problems are closely linked to rural problems. Efforts should be made to lessen the urbanization trends by developing the basic resources of water, land, and clear air in underpopulated regions. (USBR)
W70-02153

PLANNING WATER FOR 2000 A D,
Illinois State Water Survey, Urbana.
Sandor C. Csallany.
Fourth Amer Water Resource Conf, Proc Ser No 6, Amer Water Resource Ass, p 159-174, 1969. 16 p, 8 fig, 2 tab, 21 ref.

Descriptors: *Water consumption, *Water demand, *Planning, *Water supply, Watermanagement (Applied), Water requirements, Water Resources Planning Act, Water Resources Research Act, Water resources, Water resources development, Population growth, Forecasting, Legislation, Bibliographies.
Identifiers: *Water supply forecasting.

Federal legislation and studies on water resources planning for the U.S. are reviewed. The U.S. has enough water for maintaining economic growth over the next 32 yr and supporting an estimated population of 300 million in the year 2000. Water resources are not evenly distributed and severe shortages may develop in certain parts of the country. For proper planning and managing of water resources, available sources must be known and estimates made of future needs. Statistical studies of geographic areas and states show good correlation between population and water consumption. An empirical procedure is given for calculating water demand for the year 2000: first, population is projected for each state to the year 2000 and per capita water demand is estimated from the correlation between population and water consumption; second, the water demand is adjusted for increases caused by advances in technology and rising living standards. Recommendations for planning water resources for the year 2000 and beyond include using the simple estimating methods and launching a U.S. Water Resources Decade. The Decade should be governed by the U.S. Water Resources Committee, coordinating the activities of the many organizations on all phases of water resources planning. (USBR)
W70-02155

CONGRESS AND WATER RESOURCES,
Library of Congress, Washington, D.C.

For primary bibliographic entry see Field 06E.
W70-02160

THE APPLICATION OF ENGINEERING GEOLOGY IN THE REGIONAL DEVELOPMENT OF NORTHERN AND CENTRAL IRAN,
Imperial College of Science and Technology, London, (England).
For primary bibliographic entry see Field 08E.
W70-02162

EFFECTIVE MANAGEMENT OF WATER, LAND, AND AIR RESOURCES,
Battelle-Northwest, Richland, Wash.
Malcolm H. Karr.
Mater Res Stand, Vol 9, No 8, p 8-12, 63-64, Aug 1969. 7 p, 13 ref.

Descriptors: Land resources, Air pollution, *Natural resources, Water supply, Water resources, Water control, Resource conservation, Weather modification, Water quality, Irrigation, Fish and wildlife, Recreation, Navigation, *Resources, Management, Leadership, Stream pollution, Water law, *Resource development, Thermal pollution, Quality control, Flooding.
Identifiers: Air pollution control, Pollution control.

Wise resources management practices must be developed to overcome years of negligence. An interdisciplinary approach is required because of the complexity of resources management and the interrelationships among the different components. Suitable policy and understanding are lacking for effective management of environmental quality. The nature of institutional arrangements will control the effectiveness with which well-founded management recommendations can be implemented. Effective planning leadership at the state level is essential for ensuring the development of a dynamic public policy that can be successfully modified and updated as needed. (USBR)
W70-02168

A SYSTEMATIC APPROACH TO A PRACTICABLE PLAN FOR STATE AID TO LOCAL GOVERNMENTS,
Office of Research and Statistics, Washington, D.C. Long-Range Research Branch.
Ronald F. Hoffman.
Public Finance, Vol 24, No 1, p 1-32, 1969. 32 p, 3 tab, 2 append.

Descriptors: *Local governments, *Welfare, Constraints, Maryland, Taxes.
Identifiers: *State aid, *Income redistribution, *Gross aid plan, *Net aid plan, *Redistributive rule, Need, Fiscal policy, Services, Capacity, Welfare maximization, Public education, Aid distribution.

This paper is primarily concerned with income redistribution aspects of state aid to local governments. The main purpose is to present a systematic way of looking at the aid problem and to indicate how the approach can yield a usable plan for the distribution of state aid to local governments. The paper is concerned with intercounty equalization of fiscal position. This notion refers to the relationship between the need for county services and the capacity or ability to meet that need. A straight-forward application of the constrained maximization of a welfare function is used to generate a redistributive rule. The rule is practical in several senses. It does not conflict with the ideas which apparently underlie the programs which are generally acceptable to policymakers and their constituents. Furthermore, the rule is stated in a form which makes the dollar aid shares to the counties directly computable. An example, including empirical estimates of the capacity and need variables, was presented using Maryland data for 1960. Such welfare maximization approaches used to generate decision rules might be applicable to the water area with respect to state aid programs for recreation and park projects that include water development. (Loeb-Rutgers)
W70-02269

PUBLIC PERCEPTION OF WATER RESOURCE PROBLEMS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Sociology.
Charles A. Ibsen, and John A. Ballweg.
Available from the Clearinghouse as PB-188 501, $3.00 in paper copy, $0.65 in microfiche. Virginia Water Resources Research Center Bulletin 29, Sept 1969. 102 p, 62 tab, 1 append. OWRR Project A-029-VA.

Descriptors: *Attitudes, *Social aspects.
Identifiers: *Public perception.

The study dealt with the following research questions: (1) what are the factors related to public perception of water problems; (2) to what extent does the public view water as a problem and what is the basis of a problem perception; and (3) what action does the public feel should be taken toward a solution of perceived problems. A random sample of 500 was selected and these respondents were interviewed by telephone. The major findings related to public perception of water problems were: Three percent of the respondents volunteered a perception of water as a major problem facing the world today; Thirty-four percent of the respondents indicated they had considered water a problem; and The most common water problem verbalized by respondents was pollution. Correlates of a water problem perception were: Seventy-five percent of the respondents reported they had heard or read a discussion of some aspect of water problems; Television was reported as the source of information on water problems more often than any other communications media; The most common water problem reported by respondents as being discussed were water problems related to pollution. Public view of what should be done to solve water resource problems was: The majority of respondents who offered a solution to water problems felt that there was a need to enact more effective legislation; The majority of respondents felt that the private citizen and appropriate federal agencies were primarily responsible for initiation action to cope with water resource problems.
W70-02278

INSTRUMENTS FOR MEASURING ATTITUDE TOWARD A COMMUNITY WATER ISSUE,
Georgia Inst. of Tech., Atlanta.
C. Michael York.
Available from the Clearinghouse as PB-188 502, $3.00 in paper copy, $0.65 in microfiche. Water Resources Center, Georgia Institute of Technology WRC-0569, Sept 1969. 35 p, 11 tab, 19 ref, 6 append. OWRR Project B-024-GA.

Descriptors: *Attitudes, *Behavioral measurement, *Attitude measurement, *Psychological aspects, *Social behavior, *Social needs, *Social values, Social change, Social participation, Urban sociology, Decision-making, Correlation analysis, Public behavior, Political aspects, Political constraints.
Identifiers: Likert summation ratings, Thurstone equal-appearing-interval procedure.

The research objectives were: (1) to provide methodological demonstration of how attitude scaling can be accomplished in a problem-oriented context; (2) to provide an instrument suitable for use in the field as an information tool relating to a particular community water issue; and (3) to develop a better understanding of the phenomenon in question. Fluoridation of public water supplies was chosen as the issue for analysis because such an issue usually generates community conflict and an overt concern among elected officials, technical specialists and the public at large. Two traditional psychological scaling methods of attitude measurement were employed: The Likert summated ratings and the Thurstone equal-appearing-interval procedure. The end product sought was one or more instruments suitable for experimental investigation of a public policy question. An attempt at construct validation through an exploratory factor analysis of the intercorrelation matrix for the Likert items suggests that attitude toward fluoridation, the vehicle selected for the research analysis, encompasses more than 'fear of personal harm', 'violation of personal rights', and a 'public health innovation'. Measuring instruments, methods of scale construction and interpretation of the attitudes from the data collected are discussed and illustrated. These instruments and methodology are recommended to decision-makers and officials for application in the conservation, development, management, and use of water resources. The results of the studies suggest further research into issues which involve deep commitment. (Conway-Georgia Tech)
W70-02279

WATER QUALITY MANAGEMENT AND THE TIME PROFILE OF BENEFITS AND COSTS,
Water Resources Engineers, Inc., Walnut Creek, Calif.; and Washington Univ., Seattle.
For primary bibliographic entry see Field 05G.
W70-02311

ECONOMICS OF WATERSHED PLANNING.

Edited by Tolley, G S and Riggs, F E. Ames, Iowa, The Iowa State University Press, 1961. 339 p.

Descriptors: *Watershed management, *Economics, *Watersheds, *Water resources, Engineering, Planning, Resource development, Benefits, Investment, River basin development, Geology, Income, Mathematical studies, Cost sharing, Costs, Legal aspects, Conservation, Constraints, Dams, Flood control, Flood damage, Groundwater, Interest, Irrigation, Land use, Management, Recreation, Return, Wildlife.
Identifiers: *Watershed planning, Watershed development, Engineering data, Programming, Quantitative application, Public interest, Property rights, Eastern States, Flood prevention, Geography.

The increased interest in the problems of water resources in this country suggests that the desirability of advance planning is being recognized. Programs now under way are helping to accumulate experience that will be ever more valuable as water problems increase in importance. Watersheds are being developed throughout the country by building small dams, clearing stream channels, adjusting cropping patterns to control water runoff and improve incomes, and by making other investments in a small-area context. While this book is concerned partly with how small watershed development can best fit into river basin and regional planning, its more general aim is to contribute to a variety of working-level planning decisions that concern technicians, administrators, and legislators in ongoing water resources development. This volume contains the proceedings of a Symposium on the Economics of Watershed Planning held in Knoxville, Tennessee, in June 1959. The papers look at the economic, organizational and legal problems encountered in watershed planning. (See also W70-02375 thru W70-02383). (Loeb-Rutgers)
W70-02374

COMMENT ON 'WHERE DOES WATERSHED DEVELOPMENT FIT INTO THE TOTAL PICTURE OF RESOURCE DEVELOPMENT',
Wisconsin Univ., Madison.
Raymond J. Penn.
In: Economics of Watershed Planning, p 24-26, Iowa State University Press, Ames, 1961. 3 p.

Descriptors: *Resource development, Wisconsin, Water utilization, Flood control.
Identifiers: *Watershed development, Watershed programs, Economic development, Resource management.

The author contends that, in concentrating on what we do with water, we have overlooked much of the real significance of watershed programs. A watershed program exists to permit a variety of economic groups to work together. Water is the

critical resource and initially the main focus of attention, but inevitably a watershed organization finds itself considering other resources and all kinds of questions of community and economic development. For these reasons the author emphasizes the possibilities of the watershed organization as an action and planning unit for economic development as well as resource management. Water allocation is becoming increasingly involved in intergroup conflicts. There are problems of how to protect the public interest, how to maintain sufficient security of water supplies to warrant individual investment, etc. Wisconsin, as in most eastern states, has only recently become aware of major water allocation problems. New water use problems are developing that the old rules don't govern well. Procedures are needed for balancing the interests of water users in view of the availability of water. Watershed organizations are already involved in flood control. The author suggests that they give attention to other surface water problems and underground water as well. (See W70-02374). (Loeb-Rutgers)
W70-02375

WHERE DOES WATERSHED DEVELOPMENT FIT INTO THE TOTAL PICTURE OF RESOURCE DEVELOPMENT,
Soil Conservation Service, Washington, D.C.
Gladwin E. Young.
In: Economics of Watershed Planning, p 15-24, Iowa State University Press, Ames, 1961. 10 p.

Descriptors: Watershed management, Resource development, Watersheds, Cost-benefit analysis, Land development, Water resources development, Governments, Conservation, River basins, Planning.
Identifiers: *Watershed development, Concentration, Research, Data, Engineering standards.

Up to this time relatively little of the total land and water resource development has been done by government. The most important function of government in the resource field is conservation. Through conservation programs, public assistance is made available for acceptance on a voluntary basis to those who use our land and water resources. The author contends that a policy by this country to direct its efforts toward public resource development projects to the exclusion of resource conservation programs is not a defensible policy. At the same time, the opportunities for resource development through public works projects carried out by the Federal Government should not be overlooked. The author continues with a discussion on watershed planning in relation to river basin planning, the objectives of watershed development, the extent of watershed development, regional concentrations of watershed projects, the kinds of problems attacked by watershed programs, and a discussion on watershed research. All of these have important economic ramifications of which the water researcher in this area should be aware. (See W70-02374). (Loeb-Rutgers)
W70-02376

INTERDISCIPLINARY TEAMWORK IN WATERSHED PLANNING,
Soil Conservation Service, Spartanburg, S.C.
Eugene C. Buie, Ernest F. Carmichael, and John E. McLean.
In: Economics of Watershed Planning, p 87-95, Iowa State University Press, Ames, 1961. 9 p.

Descriptors: Watershed management, Economics, Geology, Engineering, Soil science, Technology.
Identifiers: *Interdisciplinary teamwork, *Watershed planning, Plant technology, Flood prevention.

Watershed project planning in the Soil Conservation Service is a coordinated analysis by a team of technicians representing various disciplines. The principle disciplines are economics, hydrology, geology, engineering, general soil science, and plant technology. There is no defined line between the areas of responsibility of each of these; each is dependent upon and interrelated with the others. Formulating a watershed plan requires that the technicians select an economically feasible system of improvements compatible with the economic and social conditions of the watershed. This paper reviews the planning process, emphasizing requirements for successful teamwork. Interdisciplinary teamwork has become almost essential in certain areas of water research due to the fact that water problems often impinge upon several areas of expertise. (See W70-02374). (Loeb-Rutgers)
W70-02377

THE STATE OF ECONOMIC DATA,
Department of Agriculture, Raleigh, N.C.
C. V. Lyle.
In: Economics of Watershed Planning, p 111-120, Iowa State University Press, Ames, 1961. 10 p.

Descriptors: Economics, Watersheds, Prices, Costs, Land use, Water use, Interest rate, Flood damage, Benefits.
Identifiers: *Economic data, Watershed planning.

The author suggests that the truism that the strength of a chain is determined by its weakest link may well be illustrated in watershed planning. The results of planning evolve from a series of interrelated statistical determinations and the dependability of conclusions rests on the accuracy of each. There are also shortcomings in the theory, philosophy, and policy of watershed planning. This paper points out that the needs for better economic data are pressing. For certain deficiencies, needs are so obvious that at times lack of improvement appears ludicrous to the planner forced to use the data available. There are also less obvious needed improvements involving more difficult relationships--those concerned with relatively complex economic principles, frequently based largely upon opinions and assumptions. The author suggests the creation of a group with the responsibility for basic data of all types needed in the study, formulation, and development of land and water resource programs. (See W70-02374). (Loeb-Rutgers)
W70-02378

MATHEMATICAL ANALYSIS: MODELS FOR QUANTITATIVE APPLICATION IN WATERSHED PLANNING,
Iowa State Univ., Ames.
Earl O. Heady.
In: Economics of Watershed Planning, p 197-216, Iowa State University Press, Ames, 1961. 20 p.

Descriptors: *Mathematical models, Investment, Welfare, Demand, Costs, Watersheds.
Identifiers: *Mathematical analysis, *Watershed planning, Restraints, Funds, Production function.

This paper presents a model for specifying the optimum scale of investment and the optimum allocation of a given investment between alternatives within a watershed. Suggestions are included on how data might be incorporated in the model and computations made to provide solutions. A complete mathematical formulation of an appropriate welfare economics model would entail specification of utility functions for individuals; demand, production, and cost functions for products both within and outside the watershed; and the calculus under which social welfare is maximized. However, this model has no current prospect for empirical application. Some of the quantities, particularly those relating to utility functions, have no promise of measurement. We must turn to some programming models of 'small watersheds in isolation' as representative of mathematical approaches which are operational in view of data availability. Even these can become extremely complex if they recognize the relevant inter-year relationships connecting activities of the system over time, the resulting 'intermediate products,' the necessary maximum and minimum restraints, the process of capital growth, the appropriate planning horizon or period and demand functions other than those representative of pure competition. (See W70-02374). (Loeb-Rutgers)
W70-02380

COMMENT ON 'PHILOSOPHY AND OBJECTIVES OF WATERSHED POLICY',
Tennessee Valley Authority, Knoxville.
Emanual L. Baum, and Leland G. Allbaugh.
In: Economics of Watershed Planning, p 13-14, Iowa State University Press, Ames, 1961. 2 p.

Descriptors: *Watersheds, Watershed management, Institutions, Cost-benefit analysis, Linear programming, Operations research, River basins, Planning.
Identifiers: Watershed development, Quantitative technique.

The authors agree with Wantrup in that certain objectives of watershed development are not expressed adequately through the market mechanism. They further agree that more thought should be given to changes in institutions to help achieve the objectives of watershed programs. However, they suggest that the value considerations that underlie existing institutions need to be critically evaluated before progress can be made in altering these institutions. While the social scientist should not try to impose values on the community, he can provide information so that policy-makers are better able to formulate their goals. While agreeing with Wantrup that the watershed is unique largely as a producing unit, the authors point out that as producing unit per se, it requires no procedures not applicable to other resources and producing units. Hence, a more positive approach might systematically examine the extent to which research procedures connected with resource use in other areas can be applied to watersheds. While Wantrup favors benefit-cost analysis, he lacks enthusiasm for other quantitative techniques. This de-emphasis of other quantitative approaches is found unacceptable by Baum and Allbaugh. Unlike Wantrup, the authors feel that there should be a distinction between river basin and small watershed programs. (See W70-02374). (Loeb-Rutgers)
W70-02381

PHILOSOPHY AND OBJECTIVES OF WATERSHED POLICY,
California Univ., Berkeley.
S. V. Ciriacy-Wantrup.
In: Economics of Watershed Planning, p 1-12, Iowa State University Press, Ames, 1961. 12 p.

Descriptors: *Watershed management, Technology, Watersheds, Prices, Economics, Economies of scale, Diseconomies of scale, Cost-benefit analysis, Constraints, Welfare.
Identifiers: *Philosophy, *Watershed policy, Policy-making, Technological change, Social sciences, Watershed projects, Objectives, Criteria, Price system.

The author proposes to focus on some of the essential concepts and principles that underlie the economics of watershed development and that need to be considered in public policy. As a proposition, one may submit that the watershed has emerged rather recently in the social sciences as a unit of understanding and policy-making. This emergence appears connected with technological change and with shifting demands for the main products of a watershed in the course of economic development. Water-quality management becomes increasingly important as the demand for products of watersheds increases. Two conclusions can be drawn from this sketch of the emergence of the watershed as a concept in the social sciences. First, the physical and economic interrelations that make the watershed a unit in the social sciences operate largely on the side of production and not on the side of consumption. Second, that a watershed as a helpful conceptual unit in the social sciences is not immutable. It is a concept of economic dynamics and not of statics. The author continues his discussion by showing the difference between the

economics of watershed policy and the economics of watershed projects. This includes a discussion pertaining to the objectives and criteria of watershed policy as well as one on benefit-cost analysis and watershed policy. (See W70-02374). (Loeb-Rutgers)
W70-02382

EQUILIBRIUM, OPTIMUM AND PREJUDICES IN CAPITAL MARKETS,
Norwegian School of Economics and Business Administration, Bergen.
Karl Borch.
Journal of Financial and Quantitative Analysis, Vol IV, No 1, p 1-14, Mar 1969. 15 p, 6 ref.

Descriptors: *Capital, *Financing, Risks, Profit, Optimization, Value, Interest rate, Prices, Economic analysis, Government, Capital supply.
Identifiers: *Invisible hand, *Bonds, *Shares, Loans, Prejudices, Capital markets.

The author wishes to show that with the introduction of uncertainty, decentralized decision making is likely to lead to a suboptimal situation. Collective action is shown to be the way in which rational people will reach an optimal situation. This requires that some of the classical assumptions about economic behavior be abandoned. To demonstrate this condition, the author discusses the problem of selecting the best investment from some set of available investments. The problem of the entrepreneur in obtaining capital either by issuing bonds or selling shares is studied and it is found that the market determines the conditions of the arrangement. The author also studies the way in which two persons will bargain in the absence of a market, and the ramifications for optimal distribution. Although it does not discuss water resource planning directly, the importance of the operation of the capital market and market mechanisms in the water resource area make this article relevant to water researchers. (Murphy-Rutgers)
W70-02384

WATERWAY INDUSTRIAL SITES: A CHICAGO CASE STUDY,
David M. Solzman.
Chicago, Illinois, University of Chicago Press, 1966. 141 p.

Descriptors: *Channels, *Sites, Illinois, Transportation.
Identifiers: *Chicago, Urban space, Michigan Canal, Industrial development, Waterfront industries, Waterway resources, Waterway land, Locational stability, Technological change, Recreational uses.

The present study traces the development of a surface waterway intended to generate new opportunites and connections for the Chicago region. Technological improvements in other modes of transportation led to a decline in the importance of this once premier resource. The author investigates the extent to which waterfront sites attract industry and whether inland waterways in central urban areas play an important role in creating increased locational stability for industries sited along the banks. It is shown that industrial growth and decline observed along the waterway is approximately the same order of magnitude as that experienced elsewhere within the city at comparable distances from the center. Where locational stability of industries along the waterway exceeds the mean index for the same distance from the city center, the increased stability or growth is shown to be related to factors other than the presence of the waterway. The author suggests that if industries continue to migrate to the periphery of urban areas, the best development for close-in riverfront lands may well be for parks and recreational uses. (Loeb-Rutgers)
W70-02386

RIVER BASIN ADMINISTRATION AND THE DELAWARE,
For primary bibliographic entry see Field 06E.
W70-02387

A NOTE ON ADMINISTERED PRICES WITH FLUCTUATING DEMAND,
Idaho Univ., Moscow.
John R. McKean.
Journal of Financial and Quantitative Analysis Vol IV, No 1, p 15-24, Mar 1969. 10 p, 1 tab, 6 ref.

Descriptors: *Prices, *Government, Economic analysis, Industrial production, Public utilities, Resource development, Cost-benefit analysis, Demand, Marginal cost, Average costs, Economics, Total cost, Monopoly, Mathematical studies, Regulation.
Identifiers: *Price stability, *Demand variability, Cost functions, Rate of return, Inventory, Regulated industries.

This article examines the price and cost behavior of non-competitive industries. The author claims the static micro theory approach to predicting average cost on the basis of expected output is unrealistic. The total distribution of expected output over the period will influence the average costs of production. Thus, predictions of average cost from secular data should take account of all relevant moments of the distribution of output. The author shows that firms may have incentive to influence the variability of demand. It is shown that if marginal cost is rising, stabilizing demand will reduce average costs. The author gives a brief explanation of how this may effect six applied pricing areas. One of the effected areas is the analysis of regulated industry, public utilities and resource development proposals. Benefit-costs or rate of return estimates may be improved by accounting for output variability in the determination of price. Thus, this article has ramifications in the water resource area. (Murphy-Rutgers)
W70-02388

PRODUCTION FUNCTIONS WITH VARIABLE ELASTICITY OF FACTOR SUBSTITUTION: SOME ANALYSIS AND TESTING,
Ryuzo Sato, and Ronald F. Hoffman.
The Review of Economics and Statistics Vol L, No 4, p 453-460, Nov 1968. 8 p, 14 ref.

Descriptors: *Capital, *Labor, *Industrial production, Economics, Mathematical studies, Technology, Wages, Cost allocation, Diseconomies of scale, Economies of scale, Costs.
Identifiers: *Production function, *CES, *VES, Capital intensity, Factor share, Marginal rate of substitution, Output.

An index of important properties of a production function is its elasticity of factor substitution function. With variable elasticity of factor substitution (VES), the production function depends on the assumptions involved in the elasticity of factor substitution function. This paper tries to show the extent to which one can generalize beyond the assumption of a constant elasticity of substitution (CES) and still derive an explicit form of the production function. Two different approaches to explicit VES production functions are discussed. The first relates the elasticity of factor substitution to capital intensity. The second approach considers the elasticity of factor substitution as a linear function of time. The potential use of production function analysis in water resource planning makes this article relevant for the water resource planner. (Murphy-Rutgers)
W70-02389

WATER PRICING THEORY AND PRACTICE IN ILLINOIS,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 06C.
W70-02391

THE LAST FRONTIER: AMERICA'S ARID PUBLIC LANDS,
Bureau of Land Management, Washington, D.C.
Eugene V. Zumwalt.
Arizona Review, Vol 18, No 12, p 1-5, Dec 1969.

Descriptors: *Arid lands, *Public lands, *Land classification, *Reclamation, *Multiple purpose project, Land management, Semiarid climates, Irrigation programs, Ranges, Range management, Decision making, Land resources, Mineral industry, Planning, Water resources, Ecology, Grazing, Water conservation, Watershed management.
Identifiers: *Western U.S.

The most common factor of the vast area of public lands of the U.S., stretching from Southern Arizona to the Arctic Ocean, is aridity. Until the 1930's use of these lands was a trial and error attempt to adapt institutions and laws of a humid land to an arid land. It did not work. Successful land reclamation for large irrigation projects required vast sums of money and technical know-how generally available only at the federal level. Uncontrolled use of non-irrigated lands for mineral exploration and exploitation and for grazing put such pressure on the fine ecological balance of the arid lands that they began to deteriorate. Where water was available for irrigation, Federal reclamation programs were developed on a long term planning basis. In 1934 the Taylor Act placed the remaining lands, where only limited moisture of an arid climate was available, under federal controls which closed it to all but carefully planned and managed use. The author reviews development of land classification schemes and programs for land-use decisions - hopefully based on knowledge of their consequences. He emphasizes that our arid lands are our last frontier. There is no place else to move in the U.S. if we make mistakes. If the arid lands are mismanaged they could become an ecological disaster. (Crouse-Arizona)
W70-02420

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE INVESTMENT DECISION FOR SEEPAGE REDUCTION,
Arizona Agricultural Experiment Station, Tucson.
Robert A. Young.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 139-143, Apr 1969. 5 p, 8 ref.

Descriptors: *Seepage, *Economic efficiency, Investment, Cost-benefit analysis.

Seepage-reduction investments appear to present no special conceptual problem. Therefore, concentrate should center on reviewing general investment principles, emphasizing that decisions which effectively represent the client's interest (whether the client is a private individual or the general public) should be based on the selection of appropriate choice criteria and models, should be based on consideration of only those cost and benefit items incremental to the decision, and should be based on appropriate valuation procedures and discount rates.
W70-02156

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 06A.
W70-02256

REPORT ON DEVELOPMENT OF A MATHEMATICAL MODEL FOR MINIMIZING CONSTRUCTION COSTS IN WATER POLLUTION CONTROL.
Camp, Dresser and McKee, Boston, Mass.
For primary bibliographic entry see Field 05G.
W70-02258

SIMULATION OF THE HYDROLOGIC-ECONOMIC FLOW SYSTEM,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 06A.
W70-02264

WATER PRICING THEORY AND PRACTICE IN ILLINOIS,
Illinois Univ., Urbana. Water Resources Center.
Hamdy H. H. Afifi, and V. Lewis Bassie.
Available from Univ of Illinois, Bureau of Economic and Business Research, Urbana, Ill, 61801, for $3.00 per copy. University of Illinois Bulletin Number 83, 1969. 153 p, 41 tab, 16 charts. OWRR Project A-008-ILL.

Descriptors: *Prices, *Economics, Illinois, Marketing, *Water rates, Costs, Rates, Use rates, Scheduling.

The economics of water supply is reviewed and the water industry in Illinois is analyzed. Rate schedules in use in Illinois are described and analyzed. Various pricing bases are discussed with comments on their frequency of use or consideration in Illinois. Eight recommendations are presented for consideration in water pricing: (1) rate schedules should be regularly reviewed and revised; (2) cost data should be compiled and analyzed annually; (3) facilities, rates and operating procedures should be adjusted to minimize water waste; (4) political considerations should be excluded from problems of operation and expansion of publicly owned systems; (5) regulatory agencies should make better use of statistics in appraising industry conditions; (6) planning of future operations should be undertaken; (7) regional federations of water systems should be considered; and (8) federal and state agencies should promote planning on a basin-wide basis.
W70-02391

6D. Water Demand

PRODUCTION AND UTILIZATION OF WATER IN THE METROPOLITAN AREA OF JACKSONVILLE, FLORIDA,
Geological Survey, Jacksonville, Fla.
For primary bibliographic entry see Field 03D.
W70-02092

INTERBASIN WATER TRANSFERS--ECONOMIC ISSUES AND IMPACTS,
Bureau of the Budget, Washington, D.C.
K. William Easter.
Fourth Amer Water Resour Conf, Proc Ser No 6, Amer Water Resour Ass, p 191-200, 1969. 10 p, 2 tab, 12 ref.

Descriptors: *Inter-basin transfers, *Water resources, Economics, Economic feasibility, Benefits, Costs, Agriculture, Irrigation water, Analysis, Water costs, Water policy, Municipal water, Industrial water, Water reuse, Water consumption, Water conveyance.
Identifiers: *Interbasin water transfer, Waste water reclamation.

Transfer of water between river basins is not new. California, Colorado, and New York have completed water transfers between basins. These transfers are small in comparison to proposals for diverting 2.4 to 30 million acre-ft of Columbia River water into the Colorado River or for diverting 16.5 million acre-ft from the lower Mississippi River to west Texas and eastern New Mexico. Such large interbasin transfers involve large investments that will be long-lived and have irreversible effects on environment. The long life of structures leads to inflexibility in water systems for incorporating technological innovations. These characteristics helpillustrate the special need for complete analysis of proposed water transfers. Some important economic issues and impacts that should be analyzed are discussed. Large, western interbasin water transfers have a potential for creating and solving economic problems. Until extensive studies are completed, the national economic value and cost of proposed water transfers are difficult to judge. These water transfers are just another possible alternative water source for certain sections of the United States needing further evaluation. (USBR)
W70-02152

ACQUISITION OF WATER FROM FEDERAL RECLAMATION PROJECTS FOR INDUSTRIAL AND COMMUNITY DEVELOPMENT,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 03E.
W70-02167

AN ECONOMETRIC MODEL FOR PREDICTING WATER-ORIENTED OUTDOOR RECREATION DEMAND,
Economic Research Service, Washington, D.C. Natural Resource Economics Div.; and Missouri Agricultural Experiment Station, Columbia.
Gleen A. Gillespie, and Durward Brewer.
US Department of Agriculture, Economic Research Service, ERS-402, p 1-15, Mar 1969. 15 p, 5 ref, 1 append.

Descriptors: *Recreation demand, Recreation facilities, Social participation, Water demand, Water utilization.

Land-use planners and investors can now make better estimates of the demand for water-oriented recreation facilities in specific areas. The estimates are made by using an econometric model developed in cooperative USDA-State research. The model, one of the first of its kind, analyzes socioeconomic characteristics associated with water-oriented outdoor recreation activities of people: annual family income, education, sex, race, age, and occupation. The model, applied to a 1,000-family sample of people in the St. Louis, Mo., area indicated that they would have averaged 27.3 days of water-oriented recreation a year. Interviews revealed that the families spent 27.0 days showing how closely the estimate followed the known data. Future demand can be estimated, with acceptable accuracy, through use of the model with data from census reports, much in the same way as the test was done. If certain socioeconomic characteristics of the population are expected to change over time, allowances can be made to estimate resulting changes in recreation demand. As a family moves up the income scale, a corresponding increase in recreation activity is expected. As education levels increase, recreation demand will increase. Because the methodology is based on a sample survey of only one metropolitan population in one time period, the appropriateness of using the model in other metropolitan areas must be carefully assessed. Other areas may have radically different characteristics, especially the available supply of outdoor recreation facilities. The coefficients (socioeconomic characteristics) should also be reassessed for changes which may occur overtime.
W70-02194

TIME-CAPACITY EXPANSION OF URBAN WATER SYSTEMS,
Stanford Research Inst., Menlo Park, Calif.
Russell F. Scarato.
Water Resources Res, Vol 5, No 5, p 929-936, Oct 1969. 8 p, 4 fig, 8 ref.

Descriptors: *Cost-benefit analysis, *Water demand, *Economies of scale, *Systems analysis, Design criteria, Decision making, Municipal water, Water distribution (Applied).

A capacity expansion model was employed to determine when and how much excess capacity should have been installed to meet increasing, exogenously determined demands at a minimum cost. The study analyzed the economic impact both of the economies of scale in construction and of the real cost of capital. The economic effects of timing and sizing decisions on total costs were plotted for various, interest rates and levels of economies of scale. The study demonstrated that the costs of expansion were sensitive to the increase in demand specific to the facility of being planned and that the design capacity must be set individually for each separable water system component according to its particular cost function. These findings suggested that the standard practice of designing excess capacity in a water system to meet a fixed future demand (i.e., 25 year system) should be revised. (Thiuri-Cornell)
W70-02267

ANALYSIS OF GROUNDWATER USE, REPLENISHMENT, AND AQUIFER CHARACTERISTICS IN BARTHOLOMEW COUNTY, INDIANA,
Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
For primary bibliographic entry see Field 02F.
W70-02288

6E. Water Law and Institutions

CONTAMINATION OF DRINKING WATER.
For primary bibliographic entry see Field 05G.
W70-02049

CITIZENS COMMITTEE FOR THE HUDSON VALLEY V VOLPE (CONSTRUCTION PERMITS WITHOUT APPROVAL AS REQUIRED BY THE RIVERS AND HARBORS ACT OF 1899).

302 F Supp 1083-1094 (SD NY 1969).

Descriptors: *Federal jurisdiction, *Navigable waters, *Road construction, *Rivers and Harbors Act, Regulation, Highways, Highway relocation, Embankments, Obstruction to flow, Navigation, Permits, Administrative agencies, Legal aspects, Judicial decisions, Dikes, Check structures, Natural resources, Hudson River, Bridges, Conservation.

Plaintiffs challenged the construction of the proposed Hudson River Expressway. They claimed that since the expressway project involved construction of dikes, causeways, and bridges over or in a navigable waterway of the United States, the Corps of Engineers exceeded its authority in issuing construction permits without approval of Congress or the Department of Transportation as required in the River and Harbors Act of 1899. The Court held that the defendant Corps had approved construction of dikes without requisite Congressional approval and had thus exceeded its authority. The Court stated that the term 'dike' should be used in its ordinary sense and that a dike did not necessarily have to affect the navigability of a stream to be defined as such. The court further found that a permit to construct causeways had similarly been issued ultra vires by the Corps. A primary function delegated to the Department of Transportation is conservation of natural resources; permitting state or private concerns to construct causeways without prior approval would tend to frustrate performance of that function. (Kelly-Florida)
W70-02061

WATER QUALITY STANDARDS SUMMARY.
Federal Water Pollution Control Administration, Helena, Mont.
For primary bibliographic entry see Field 05G.
W70-02069

CANALS AND POOLS.

Pa Stat Ann Tit 55, Secs 801-803, 809, 822, 823, 824 (Supp 1969).

Descriptors: *Pennsylvania, *Canals, *Artificial watercourses, *Navigation, Conveyance structures, Legislation, Transportation, Boats, Inland waterways, Canal construction, Berms, Administrative agencies, Highways, Embankments, Banks, Docks, Regulation, Boating regulations, Diversion, Maintenance, Industrial water, Domestic water, Water utilization.
Identifiers: *Obstructions to navigation.

It is unlawful to lead or drive any animal upon the towing path of any canal or pool except for the purpose of towing boats upon the waters of such artificial navigation. It is unlawful for any boat, craft, or floatable thing to be so moored or placed in any such canal as to obstruct the use thereof. Willful obstruction of navigation by any means is punishable by a fifty dollar fine. Any property abandoned on the banks or waters of such canals may be seized and sold at auction by canal officers. The Canal Commissioners may authorize the construction and use of wharves by landowners adjoining such canals so long as the wharves do not interfere with free navigation. Purchasers of state canals must keep the canals in a condition of repair and fitness for use equal to that at the time of purchase. Any person vested with the franchise of constructing, maintaining, and using a canal may convert the waters therein to domestic manufacturing and commercial uses. (Schram-Florida)
W70-02127

CONTROL AND DRAINAGE OF WATER FROM COAL MINES.

Pa Stat Ann Tit 52, Secs 682-683 (1966).

Descriptors: *Pennsylvania, *Mine water, *Mine drainage, *Coal mines, Legislation, Mining engineering, Safety, Flood control, Backfill, Hydraulic mine-filling, Public health, Landfills, Ditches, Flumes, Hydraulic mining water, Administrative agencies, Streambeds, Stream improvement, Pumping, Pumps, Federal project policy, Financing.

In the event that federal money is made available on a matching basis for the control and drainage of water from coal formations, to seal abandoned coal mines, and to fill voids in abandoned mines, the state accepts the aid subject to the terms and conditions of the grant. In such event, the Department of Mines and Mineral Industries shall construct ditches, flumes, backfill stripping pits and cropfalls, and improve stream beds for the purpose of preventing the flow of water into mines. They shall also purchase the necessary materials to pump water from abandoned mines, and to seal and fill voids in abandoned coal mines. The state, however, shall not bear any operating or maintenance costs other than one-half of the power pumping costs except in cases of emergencies. When an emergency exists, the Department shall: (1) conduct rescue operations; (2) purchase equipment and provide labor for pumping water or other necessary work to reduce the hazards from flooding; (3) pay for power and other costs for mine drainage; and (4) conduct investigations to determine the cause of the disaster and to institute measures to insure the future safety and health of persons in the area. (Schram-Florida)
W70-02128

INTERSTATE COMPACTS FOR PROTECTION OF RESOURCES.

R I Gen Laws Ann Secs 46-17-1 (1956), 46-17-2 thru 46-17-5 (Supp 1968).

Descriptors: *Rhode Island, *Interstate compacts, *Water resources development, *Administrative agencies, Legislation, Legal aspects, Interstate commissions, Interstate rivers, Water policy, Water resources, Optimum development plans, Conjunctive use, Water management (Applied), Water rights, Administration, Planning, Investigations.
Identifiers: *Northeastern Resources Commission.

The governor is authorized to enter into an interstate compact for protection of the water resources of Rhode Island originating outside of that state and for protection of water resources of other states originating within Rhode Island. The northeast part of the United States requires coordinated planning for effective water resource management; the purpose of the compact is to provide an organization for cooperation in planning and coordinating policies and programs in the field of water and related land resources. The Northeastern Resources Commission by virtue of the compact will be responsible for coordinating, planning, investigating, and programming water and related land resources development. Nothing in this compact is deemed to impair or supersede the authority or jurisdiction of an existing interstate agency or agreement. The Rhode Island legislature has approved the compact and hereby grants the state's representatives all powers necessary and incidental to carry out the proper purposes of the Commission. (Kelly-Florida)
W70-02135

SEVERANCE STUDIES,
James H. Boykin.
Right Way, Vol 16, No 4, p 16-21, Aug 1969. 6 p.

Descriptors: *Severance, *Right-of-way, Appraisals, Project planning, *Land appraisal, Surveys, Legal aspects, Economics, Real property, Unit costs, Value, Analysis, Highways.
Identifiers: *Land acquisition, Highway engineering, *Partial taking.

An analysis was undertaken to find ways of modifying state highway right-of-way severance studies (land economic studies) to provide independent fee appraisers with valuable and much-needed appraisal data. The findings would probably improve the accuracy and reliability of remainder parcel appraisals, leading to increased effectiveness of appraisers' court testimony as expert witnesses. Severance study data are generally very complete; less than half the highway department studies contain adjustments for nonright-of-way influences on value. State personnel conducting the studies are considered to be well trained. Over half the studies are designed to assist appraisers in estimating the values of remainder parcels. Less than 20% of the reports are intended for use as outright comparable remainder sales, but independent appraisers use them almost as often as sales data as for value lost (or gained) severance studies. Studies are readily available from highway departments. Severance studies generally have not been allowed in court; over half the studies allowed are restricted to being used as comparable sales. (USBR)
W70-02147

BOUNDARIES, JURISDICTION AND EMBLEMS.

Va Code Ann secs 7.1-14, 7.1-17, 7.1-20 (1966).

Descriptors: *Virginia, *Lighthouses, *Federal jurisdiction, *State jurisdiction, Easements, Condemnation, Right-of-way, Marshes, Coastal marshes, Channels, Canal construction, Navigation, Leases, Taxes, Regulation, Harbors, Boundaries, Eminent domain, Construction, Natural resources, Forests, Agriculture, Navigable waters, Rivers.

The Governor has the authority to convey or lease to the United States any land belonging to the state for the site of a lighthouse, beacon, lifesaving station, or other aid to navigation. Title to such land reverts to the state unless construction is begun within two years and completed within ten years or if its use is discontinued for five years. Although jurisdiction over such land is ceded to the Federal Government, Virginia reserves certain express rights therein. The conditional consent of Virginia is given to the United States to acquire land by eminent domain in Virginia for: (1) the conservation of forest or natural resources; (2) the retirement of submarginal agricultural lands from cultivation and utilization, (3) the improvement of rivers and harbors; and (4) any other purpose of the United States. The Governor may convey certain marshes to the United States for canal or channel construction. He may also convey certain vacant, waste, and unappropriated lands to the United States. (Schram-Florida)
W70-02150

CONGRESS AND WATER RESOURCES,
Library of Congress, Washington, D.C.
Theodore M. Schad.
Fourth Amer Water Resource Conf, Proc Ser No 6, Amer Water Resource Ass, p 680-691, (1969). 12 p, 1 tab, 6 ref.

Descriptors: *Water resources, *Federal government, *Legislation, *Policy matters, Legal aspects, Committees, Planning, Projects.
Identifiers: Bureau of Reclamation, Corps of Engineers, Federal agencies, *United States Congress.

The pervasive nature of water resources and effects on all aspects of the national economy are shown in an analysis of Congressional handling of related legislation. In the 89th Congress, 1279 legislative measures (more than 5% of the bills and joint resolutions introduced) were concerned with water resources. Under the rules of the U.S. Senate and House of Representatives governing referral of bills, the water resources measures were referred to 11 committees in the Senate and 13 in the House. As a result, opportunities exist for promulgation of inconsistent policies for similar programs emanating from different committees. One recent tendency has been for committees to recommend legislation cutting across jurisdictional lines to provide uniform policies applicable to all Federal programs. Nevertheless, many problems of divided responsibility for water resources in the Executive branch are linked to the organization of Congress for dealing with water resources. (USBR)
W70-02160

ABANDONED MINES.
For primary bibliographic entry see Field 05G.
W70-02163

SHELLFISH GROUNDS AND PACKING HOUSES.

R I Gen Laws Ann secs 21-14-1 thru 21-14-9, 21-14-11, 21-14-14, 21-14-15 (1968).

Descriptors: *Rhode Island, *Commercial shellfish, *Water pollution, *Public health, Shellfish, Aquatic animals, Commercial fish, Commercial fishing, Aquatic life, Aquatic environment, Permits, Fish management, Administration, Administrative agencies, Regulation, Standards, Sewage, Dredging, Legislation, Environmental sanitation, Condemnation, Water quality, Fishkill.

A license is required for the operation of any shellfish business. The Director of the State Department of Health is charged with: investigating license applicants for compliance with the provisions of this chapter; adopting regulations requiring sanitation in the shellfish business; and investigating the sanitary condition of the waters overlying shellfish grounds. Waters found to be unsatisfactory are declared polluted. The Director is to consider the volume and dilution of sewerage, bacteria, and distance from polluted areas in making such declarations. No person shall take shellfish from polluted areas except for transplanting such shellfish by permit. No person shall work a dredge, pair of tongs, or rake while in a polluted area. No person shall sell or possess any shellfish taken from a poluted area. The Director shall adopt regulations and enforce the provisions of this act. Appointed enforcement agents may arrest persons or seize shellfish, boats or implements when violations of this chapter are discovered. Penalties for violations are enumerated. (Smith-Florida)
W70-02268

INSTRUMENTS FOR MEASURING ATTITUDE TOWARD A COMMUNITY WATER ISSUE,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 06B.
W70-02279

RIVER BASIN ADMINISTRATION AND THE DELAWARE,
Roscoe C. Martin, Guthrie S. Birkhead, and Jesse Burkhead.
Syracuse, New York, Syracuse University Press, 1960. 390 p.

Descriptors: *Delaware River, *Financial feasibility, *Financing, *River basins, River basin development, Water resources development, Governments, Economics, Legal aspects, Organizations, Financial analysis, Water resources, Industrial water, Water demand, Water management, Administration, Water quality, Water pollution, Planning, Irrigation, Recreation, Flood control, Watershed management.
Identifiers: *River basin administration, Basin agency, Basin development, Regional action, Intrastate basin development, Interstate basin development, Delaware River Basin, Water quantity.

This study develops the position that the most appropriate organization for the administration of the Delaware River's water resources in their larger setting is a Basin-wide agency with jurisdiction over water and water-related activities. The new agency will not supersede the traditional units of government, but on the contrary will build on and strengthen existing national, state, and local agencies and programs. Its chief responsibility will be to introduce an overview of Basin water problems, to plan a comprehensive water program, and by complementary action to assist in effectuating the Basin plan. Its principal influence on existing governments may be expected to result from persuasion and example, and from the introduction of positive thinking through assertion of leadership. It is the purpose of this study by making a systematic examination of the problems of river basin administration to provide background for effective action in the increasingly complex field of water-resource management. (Loeb-Rutgers)
W70-02387

6F. Nonstructural Alternatives

FLOODS ON LEVISA FORK IN VICINITY OF PAINTSVILLE, KENTUCKY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-02121

FLOODS IN UPPER MILLSTONE RIVER BASIN IN VICINITY OF HIGHTSTOWN, NEW JERSEY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-02122

FLOODS ON SUSQUEHANNA RIVER AT ONEONTA, NEW YORK,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-02123

6G. Ecologic Impact of Water Development

ECOLOGICAL EFFECTS OF WEATHER MODIFICATION: A PROBLEM ANALYSIS,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
Charles F. Cooper, and William C. Jolly.
Mich Univ School Natur Resources Rep, May 1969. 160 p, 140 ref. Contract 14-06-D-6576, (Bur of Reclam, Office of Atmos Water Resources, Denver, Colo.)

Descriptors: *Weather modification, *Cloud seeding, *Environmental effects, Vegetation effects, Biology, Diseases, Ecology, Growth rates, Habitats, Insect resistance, Water pollution, Insecticides.
Identifiers: Weather modification effects.

The ecological effects of weather modification are discussed and the existing literature on the subject is surveyed. If deliberate modification of weather can be achieved, the structure of plant and animal communities will be altered through shifts in rates of reproduction, growth, and mortality of weather sensitive species. Ecological changes will generally require several years to become fully evident. Weather modification may interact with other ecological stresses such as air pollution and pesticide application to produce changes greater than the sum of the individual effects. Catastrophic outbreaks of weeds or insect pests are unlikely but not impossible. Big game animals could be adversely affected if snow accumulation is significantly increased on winter range. There does not appear to be an immediate serious threat of environmental contamination from silver iodide or other seeding agents. A global environmental monitoring system is urgently needed. Anticipated kinds of weather modification, effects in semiarid climates and in humid climates, pests and diseases, direct effects of seeding agents, biology of lakes and streams, fog, hail, lightning, and hurricane modification, environmental monitoring programs, inferences from ecological theory, recommended research, and recommended pre-modification field surveys are included in the discussion. (Knapp-USGS)
W70-02323

07. RESOURCES DATA

7A. Network Design

DECADE REPRESENTATIVE AND EXPERIMENTAL RESEARCH BASINS IN THE UNITED STATES.

US Nat Comm Rep for Int Hydrol Decade, 1969. 267 p, 60 map.

Descriptors: *Demonstration watersheds, *Watersheds (Basins), Education, Model studies, Rainfall-runoff relationships, Land management, Water management (Applied), Research and development, Streamflow forecasting.
Identifiers: *Experimental watersheds, Representative watersheds.

The 60 experimental and representative study areas for watershed research in the U.S. are listed, described, and shown by maps. The watersheds are in 22 States and encompass a wide variety of physiographic types and climatic environments. An experimental basin is one that has been chosen and instrumented for the study of hydrological phenomena. A representative basin is one that has been chosen and instrumented to represent a broad area, as an alternative to making measurements in all basins of a comparatively homogeneous region. (Knapp-USGS)
W70-02064

TOPOLOGICAL PROPERTIES OF CHANNEL NETWORKS,
IBM Watson Research Center, Yorktown Heights, N.Y.
For primary bibliographic entry see Field 02J.
W70-02101

7B. Data Acquisition

FEASIBILITY STUDY OF THE USE OF THE ACOUSTIC VELOCITY METER FOR MEASUREMENT OF NET OUTFLOW FROM THE SACRAMENTO-SAN JOAQUIN DELTA,
Geological Survey, Washington, D.C.
Winchell Smith.
Geol Surv Water-Supply Pap 1877, 1969. 54 p, 21 fig, 13 tab, 10 ref.

Descriptors: *Streamflow, *Instrumentation, *Bays, *Deltas, *California, Hydrologic budget, Estuaries, Current meters, Velocity, Acoustics, Stream gages, Discharge (Water).
Identifiers: Acoustic velocity meters, Sacramento River (Calif), Sacrament-San Joaquin Delta (Calif).

A reliable measure of the fresh-water outflow from the Sacramento-San Joaquin delta is needed for the operation of the California Water Project and for the evaluation of the interrelated water problems of the delta and San Francisco Bay regions. The Chipps Island channel, immediately downstream from the confluence of the Sacramento and San Joaquin Rivers, is the most promising site for this flow measurement, but the conventional techniques used for evaluating steady flows cannot be employed there because the channel reach is in the tidal zone, and reversals of flow occur during each tidal cycle. Net outflows, which may be as little as 2,000 cu ft per second must necessarily be computed as the difference between the large ebb-flow and floodflow volumes that move back and forth between the delta region and San Francisco Bay. Discharges during peak periods of the ebb and flood tidal cycles may exceed 300,000 cu ft per second. In consequence, a very high degree of precision must be maintained in the gross flow measurements if meaningful computations of net outflow are to be made. The probable accuracies of an AVM (acoustic velocity meter), a device which measures the stream velocity along a diagonal line across the channel are evaluated. This line velocity will provide a stable index of the mean velocity in the channel and such an index could be used as a primary parameter for the computation of discharge. (Knapp-USGS)
W70-02053

THE USE OF DOPPLER RADAR EQUIPMENT TO DETERMINE THE VERTICAL AIR VELOCITY IN RAIN,
A. G. Gorelik, and V. F. Logunov.
Izvestiya Akademii Nauk SSSR, Seriya Fiziki Atmofery i Okeana, Vol 5, No 5, p 543-545, May 1969. Translated from Russian.

Descriptors: *Rain, *Raindrops, *Wind velocity, *Radar, Instrumentation, Calibrations, Weather forecasting, Meteorology.
Identifiers: *Doppler radar, Meteorological radar.

Doppler radar may be used to find the vertical air velocity in rainstorms. Radar reflectivity is a function of rainfall intensity, average drop-size, and average still-air rainfall velocity. Doppler radar measures actual raindrop velocity; comparison of the still-air and actual velocities yields an estimate of air velocity with an average error of about 1.5 m/sec. (Knapp-USGS)
W70-02056

SUSPENDED SOLIDS MONITORING: A COMPARISON BETWEEN THREE INSTRUMENTS,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
George Fleming.
Water and Water Eng, Vol 73, No 883, p 377-382, Sept 1969. 6 p, 5 fig, 3 photo, 4 tab, 7 ref.

Descriptors: *Suspended load, *Monitoring, *Instrumentation, *Measurement, Analytical techniques, Silting, Sampling, Rivers, Streamflow, Statistical methods, Discharge (Water), Rainfall, Sedimentation, Erosion.
Identifiers: Suspended solids monitoring.

Three commercially available suspended solids monitors were tested under field conditions and a comparison of the results obtained is presented. The monitors are: the Davall Siltmeter, the Southern Analytical Suspended Solids Monitor, and the Fleming Siltmeter. The instruments yield results of similar accuracy when used to measure the suspended solids concentrations in streams. (Gabriel-USGS)
W70-02067

THE TIME INTERVAL BETWEEN STABILIZATION OF ALPINE GLACIAL DEPOSITS AND ESTABLISHMENT OF TREE SEEDLINGS,
Geological Survey, Washington, D.C.
Robert S. Sigafoos, and E. L. Hendricks.
Geol Surv Res 1969, Prof Pap 650-B, p B89-B93, 1969. 5 p, 1 fig, 1 tab, 9 ref.

Descriptors: *Dating, *Glacial drift, *Dendrochronology, *Trees, Age, Geologic time, History, Climatology, Ecology, Forests, Growth rates, Paleoclimatology, Plant growth.
Identifiers: *Tree establishment (New sediments).

Determining the age of the oldest tree growing on a recent deposit can be a reliable technique for estimating the age of the deposit. The main source of error in such an age estimate is the interval between stabilization of the deposit and germination of tree seedlings. The availability of seed, the presence of a seedbed of fine-grained material, and a favorable climate are the principal controls in the establishment of trees. These conditions are met in valley bottoms at Mount Rainier, Wash., where tree ages were compared with known ages of recently deposited moraines. Based on ages of more than 150 trees growing on surfaces of known age, the interval between sediment stabilization and tree seed germination is estimated to be 5 years for bottomland sites at Mount Rainier. Dating of a recently deposited pumice layer and determining the ages of trees growing on an underlying moraine near timberline show that the interval is longer at high altitudes than at lower altitudes. (Knapp-USGS)
W70-02075

CORRELATION OF CARBONATE ROCK UNITS IN NORTHWEST OHIO BY NATURAL GAMMA LOGGING,
Geological Survey, Columbus, Ohio.
Stanley E. Norris, and Richard E. Fidler.
Geol Surv Res 1969, Prof Pap 650-B, p B158-B161, 1969. 4 p, 3 fig.

Descriptors: *Structural geology, *Aquifers, *Carbonate rocks, *Ohio, *Radioactive well logging, Hydrogeology, Hydrologic data, Permeability, Transmissivity, Geology, Stratigraphy.
Identifiers: Gamma-ray well logging.

Natural gamma logs are a basis for determining the contact between the principal carbonate rock units in northwest Ohio, those of the Niagara and Cayuga Groups. Logs of the upper part of the Niagara Group, a dolomite of high purity, show a relatively low intensity of radiation and are almost featureless, in marked contrast to logs of the slightly less pure dolomite of the overlying Cayuga rocks. A characteristic change in radioactivity at or near the contact is identifiable on most logs in the study area. Data from 26 wells, supplemented by that obtained from quarry exposures, have been used to construct a structure contour map which conforms closely to the known regional structure. This map will be a significant aid in the interpretation of the hydrogeologic system in northwest Ohio. (Knapp-USGS)
W70-02079

REDUCTION OF FLUORESCENCE OF TWO TRACER DYES BY CONTACT WITH A FINE SEDIMENT,
Geological Survey, Albuquerque, N. Mex.; Geological Survey, Anchorage, Alaska; and Geological Survey, San Juan, Puerto Rico.
C. H. Scott, V. W. Norman, and F. K. Fields.
Geol Surv Res 1969, Prof Pap 650-B, p B164-B168, 1969. 5 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Tracers, *Adsorption, *Clays, *Dye releases, *Flow measurement, Streamflow, Flow rates, Tracking techniques, Fluorescence, Sediments, Silts, Arid lands.
Identifiers: *Dye adsorption.

Loss of dyes such as Rhodamine WT, Pontacyl Pink B, and Rhodamine B on clays and silts during discharge measurements in streams of the arid Southwest is a potential problem. A study of loss of fluorescence of Rhodamine WT and Pontacyl Pink B on fine sediment from the Rio Puerco near Bernardo, New Mexico showed that the loss was independent of the concentration of dye but was dependent on the concentration of sediment. Also, all the loss took place in less than 30 minutes. The loss of fluorescence may be related to characteristics of the sediment such as mineralogical composition, surface area per unit weight of material, and perhaps others. (Knapp-USGS)
W70-02080

DETERMINATION OF TRACES OF SILVER IN WATERS BY ANION EXCHANGE AND ATOMIC ABSORPTION SPECTROPHOTOMETRY,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W70-02099

EFFECT OF HOUSING SHAPE ON THE CATCH OF RECORDING GAGES,
Illinois State Water Survey, Urbana.
Douglas M. A. Jones.
Monthly Weather Rev, Vol 97, No 8, p 604-606, Aug 1969. 3 p, 2 fig, 4 tab, 8 ref.

Descriptors: *Rain gages, *Calibrations, *On-site tests, Statistical methods, Data collections, Instrumentation.
Identifiers: Rain gage housings, Gage housing effects.

Reduction in catch due to the shape of the housing of the U. S. Weather Bureau standard recording gage was explored using data from Weather Bureau stations with both recording and nonrecording gages, a gaging site which included both a standard nonrecording gage and a Stevens recording gage, and gages on the East Central Raingage Network. The standard 8.0-in. diameter orifice recording gage caught 2.5 to 6% less rain than the nonrecording gage and 2.5% less rain than the recording gage fitted with a 12-in. diameter orifice. The Stevens recording gage caught 5.5% less rain than the nonrecording gage. It is concluded that proximity of a sloping portion of the gage housing on the 8-in. diameter orifice recording gages is responsible for the catch reduction. (Knapp-USGS)
W70-02102

PROBLEMS OF BED LOAD TRANSPORT IN FRENCH WATERWAYS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
For primary bibliographic entry see Field 08B.
W70-02104

ION-SELECTIVE ELECTRODES -- THEORY AND APPLICATIONS IN WATER ANALYSIS,
Pittsburgh Univ., Pa. Graduate School of Public Health.
For primary bibliographic entry see Field 05A.
W70-02112

MEASUREMENT OF SOIL MOISTURE IN THE FIELD BY NEUTRON MODERATION,
Rothamsted Experimental Station, Harpenden (England).
I. F. Long, and B. K. French.
J Soil Sci, Vol 18, No 1, p 149-166, Mar 1967. 18 p, 10 fig, 1 tab, 10 ref.

Descriptors: *Soil moisture, *Nuclear moisture meters, Temperature, Evaporation, Irrigated land, Barley, Humidity, Grasslands, Hydrogen, Calibrations, Instrumentation.
Identifiers: Field soil moisture measurement.

A soil-moisture neutron probe which uses as a source Am-Be has a boron triflouride detector. A desired linear relationship between thermal neutron count and the volumetric water content is achieved by having the source and detector as close to each other as possible. Field trials were made in 1962 and 1963 in bare clay soil and under barley crop, and in 1964 under timothy and meadow fescue, both irrigated and non-irrigated conditions. The periodic evaporation was in good agreement in the aerodynamic estimates based on humidity, wind profiles and temperature. (Carstea-USGS)
W70-02124

SEEPAGE DETECTION BY REMOTE SENSING,
HRB-Singer, Inc., State College, Pa. Radiometrics Lab.
Thomas R. Ory.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 128-133, Apr 1969. 6 p, 3 photo, 2 tab, 2 chart.

Descriptors: *Seepage, *Remote sensing, Radar, Infrared radiation.

A number of remote sensing techniques have been shown to have application in the detection and evaluation of seepage. Radar and infrared sensors are presently available for use in seepage detection research and, to a limited extent, for operational work. When these sensors are used after a careful analysis of the detection problem, and with utilization of the information available from conventional techniques, the success probability of remote seepage detection should be very good. Future research will undoubtedly yield less expensive and more reliable remote sensors for this application as the payoffs from initial employment begin to stimulate their use.
W70-02169

FIELD EVALUATION OF SEEPAGE MEASUREMENT METHODS,
Idaho Univ., Moscow. Engineering Experiment Station; and Argicultural Research Service, Kimberly, Idaho. Snake River Research Center.
C. E. Brockway, and R. V. Worstell.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 121-127, Apr 1969. 7 p, 2 tab, 3 chart, 6 ref.

Descriptors: *Water measurement, *Seepage, Canal seepage, Ponding, Inflow, Discharge (Water), Flowmeters, Instrumentation.
Identifiers: *Seepage measurement.

Of the available methods for evaluating seepage losses, the ponding test is the most accurate but the most expensive. The use of seepage meters for obtaining estimates is fast and economical. However, new types of meters capable of functioning in canals at operating depth should be studied. Almost all the available meters are capable of measuring seepage with reasonable accuracy at a point, but discretion must be used in the amount of confidence placed in average values determined from meters tests. The procedure outlined for estimating the number of meter tests required can be used to judge the confidence to be placed in any group of tests. Inflow-outflow methods are usually too expensive to be used for short-duration seepage measurements. However, a good installation does indicate seasonal changes in loss rates. Accuracy of inflow-outflow determinations is limited by the flow-measuring devices, but for canals with large seepage losses, inflow-outflow methods may be the most expedient and sufficiently accurate.
W70-02179

FEASIBILITY STUDY OF ELECTRICAL GEOPHYSICAL METHODS IN THE DETERMINATION OF SUBSURFACE HYDROGEOLOGIC ENVIRONMENTS IN THE PIEDMONT AREA OF SOUTH CAROLINA,
Clemson Univ., S.C. Water Resources Research Inst.
Thomas L. Drake.
Available from the Clearinghouse as PB-188 286, $3.00 in paper copy, $0.65 in microfiche. Report

No 11, Water Resources Research Institute, Clemson University, July 1969. 96 p, 62 fig, 21 ref. OWRR Project A-011-SC.

Descriptors: *Resistivity, Exploration, Geophysics, Groundwater, South Carolina, Soundings.
Identifiers: *Induced polarization, Piedmont, Traverses.

The effectiveness of electrical resistivity and electrical induced polarization techniques as an aid in the determination of the subsurface hydrogeologic environments in the Piedmont area of South Carolina is investigated. This investigation involved the simultaneous resistivity and induced polarization soundings and traverses over the somewhat known geologic and hydrologic environments of the Clemson Research Watershed. Results show that the resistivity method generally provided a delineation of the bedrock lithologies, soil and subsoil horizons, overburden saturated with groundwater, and unsaturated overburden. Conclusions are based on twelve lines of resistivity traverses having a total length of approximately 12,000 feet. The Wenner array using a spread of 20 feet, expanded six times to yield a maximum spread of 140 feet, was the primary electrode configuration. Additional resistivity soundings were generally performed every seven stations, 140 feet, with a spread of 2 feet, expanded three times. At selected stations, electrical induced polarization data was acquired. The apparent resistivities of the area range from approximately 210 ohm-meters to about 4,000 ohm-meters. No induced polarization activity was observed.
W70-02241

ECONOMIC DECISION FRAMEWORK FOR THE EFFICIENT USE OF DATA SOURCES,
Harvard Univ., Cambridge, Mass.
Gerhard Tschannerl.
Rep, Int Conf Arid Lands Changing World, June 1969. 31 p, 12 fig, 1 tab, 10 ref.

Descriptors: *Decision making, *Data transmission, *Streamflow, *Stochastic processes, *Hydraulic design, Economic prediction, Reservoirs, Numerical analysis, Statistical methods, Cost analysis.
Identifiers: Deterministic model.

The estimation of the statistical parameters of streamflow as a source of the knowledge required for decision making about the design and operation of hydraulic structures was presented. The objective of the paper was to: (1) show that under certain circumstances data that are correlated with the event that is being studied can be used to get a better design of the hydraulic structure; and (2) describe a way in which this operation can be carried out. A stochastic model and deterministic model were developed for hydraulic variables and for economic input variables respectively. A numerical example illustrated the use of the model. The availability of several sources of data with differing statistical and cost characteristics could be envisaged, from among which a choice could be made. The principles that were discussed could be applied to a wide variety of situations. (Thiuri-Cornell)
W70-02271

SNOW COVER DISTRIBUTION AS MAPPED FROM SATELLITE PHOTOGRAPHY,
Allied Research Associates, Inc., Concord, Mass.
James C. Barnes, and Clinton J. Bowley.
Water Resources Res, Vol 4, No 2, p 257-272, Apr 1968. 16 p, 10 fig, 19 ref. ESSA Contract No Cwb-11269.

Descriptors: *Snow cover, *Photography, *Satellites (Artificial), Watersheds (Basins), Clouds, Networks, Mapping, Winter, Remote sensing, Photogrammetry, Surveys.
Identifiers: *Snow cover mapping, Satellite photography.

Utilizing data from 3 winter seasons, snow cover distributions in the relatively flat terrain of the Missouri and Upper Mississippi River basins are mapped from satellite photography. Techniques are developed for identifying snow cover and for differentiating between snow and cloud. Comparisons between snow data observed by satellites and snow data conventionally acquired indicate that, in almost all cases, snow can be distinguished from cloud on the bases of current cloud reports, pattern continuity, landmark identification, and texture. Snow cover can be mapped from Tiros or Essa resolution photography with an accuracy of approximately 20 miles, often providing a more detailed mapping than can be obtained from conventional station networks. Qualitative estimates of snow depth can also be obtained from satellite photography. In nonforested areas, reflectivity increases with snow depth, until an accumulation of about 4 to 6 inches is reached; after that, the reflectivity remains unchanged. In forested areas, no discernible relationship between reflectivity and snow depth is observed. (Carstea-USGS)
W70-02314

LABORATORY THEORY AND METHODS FOR SEDIMENT ANALYSIS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-02316

STATISTICAL DISCRIMINATION OF CHANGE IN DAILY RUNOFF,
Colorado State Univ., Fort Collins. Dept of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-02330

7C. Evaluation, Processing and Publication

GROUNDWATER LEVELS IN THE UNITED STATES, 1962-66, NORTH-CENTRAL STATES,
Geological Survey, Washington, D.C.
C. L. McGuinness.
Geol Surv Water-Supply Pap No 1976, 1969. 117 p, 10 fig.

Descriptors: *Water levels, *Observation wells, Water wells, Networks, Data collections, Hydrologic data, Aquifers.
Identifiers: North Central U.S.

Data from the basis network of observation wells in the North Central States, 1962-66 is tabulated. Each record includes well location, well number, owner, type and construction, aquifer, diameter, depth, casing type, gage type and history, record high and low water levels, and a table of periodic observations. (Knapp-USGS)
W70-02044

VARIATIONS IN LOW-WATER STREAMBED ELEVATIONS AT SELECTED STREAM-GAGING STATIONS IN NORTHWESTERN CALIFORNIA,
Geological Survey, Washington, D.C.
John J. Hickey.
Geol Surv Water-Supply Pap 1879-E, p E1-E33, 1969. 33 p, 1 plate, 1 tab.

Descriptors: *Channel morphology, *Alluvial channels, *Streambeds, *California, Stream erosion, Aggradation, Sedimentation, Scour, Surveys.
Identifiers: *Streambed elevations.

Graphs and a table are presented showing the variations in streambed elevations that have occurred over the years in the low-water channels at selected gaging stations in northwestern California. The streambed elevations are calculated from data obtained during discharge measurements. The greatest elevation changes that were recorded occurred between the 1964 and 1965 low-water periods. Those streambed changes are related to the flood of December 1964 and probably reflect large quantities of sediment placed in the streams from bank erosion and landslides. At 25 of 51 stations with data for that period, elevation changes exceeded 1 foot, and at 42 stations the changes represented fill, rather than scour. (Knapp-USGS)
W70-02045

AERIAL-PHOTO INTERPRETATION IN CLASSIFYING AND MAPPING SOILS.
Soil Conservation Service, Beltsville, Md.

Avail from Superintendent of Doc, US Government Printing Office, Wash, DC, 20402 -- Price $0.75. Soil Conserv Agr Handbook 294, Oct 1966, Reprinted 1968. 89 p, 68 fig, 2 tab, 19 ref.

Descriptors: *Mapping, *Aerial photography, *Photogrammetry, *Soil surveys, Soil investigations, Geologic mapping, Hydrography, Terrain analysis, Topography.
Identifiers: Soil mapping.

The use of aerial photographs in making soil surveys is explained in a manual intended primarily for soil scientists and others directly engaged in the national soil survey of the U.S. The principles should be of use to anyone else working in soil mapping, geological mapping, or air photograph interpretation. (Knapp-USGS)
W70-02066

APPLICATION OF POISSON DISTRIBUTION TO FLOOD SERIES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-02078

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1964 -- PARTS 3 AND 4.
Geological Survey, Washington, D.C.

Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402 -- Price $2.00. Geol Surv Water-Supply Pap 1955, 1969. 440 p, 1 fig, 32 ref.

Descriptors: *Data collections, *Surface waters, *Water quality, Lakes, Reservoirs, Water temperature, Sediment discharge, Turbidites, Water chemistry, Chemical analysis.
Identifiers: Surface water records, Water quality records, Water resources data, Ohio River Basin, St. Lawrence River Basin.

The surface-water records for the 1964 water year for gaging stations, partial-record stations, and miscellaneous sites in the Ohio and St. Lawrence River Basins are presented. The data generally comprise a description of the station and tables showing the results of water quality measurements of the stream. The description of the station gives the location, drainage area, records available, and general remarks. Chemical quality, fluvial sediment, and water temperatures are listed. The chemical quality includes concentrations of individual dissolved constituents, hardness, specific conductance, and pH. Fluvial-sediment information is given for suspended-sediment discharges and concentrations. Water-temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. (Knapp-USGS)
W70-02114

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1964 -- PARTS 1 AND 2.
Geological Survey, Washington, D.C.

Avail from Superintendent of Doc, US Government Printing Office, Wash DC, 20402 -- Price $2.75. Geol Surv Water-Supply Pap 1954, 1969. 606 p, 1 fig, 32 ref, index.

Descriptors: *Data collections, *Surface waters, *Water quality, Lakes, Reservoirs, Water temperature, Sediment discharge, Turbidites, Water chemistry, Chemical analysis.
Identifiers: Surface water records, Water quality records, Water resources data, Eastern U.S.

The surface-water records for the 1964 water year for gaging stations, partial-record stations, and miscellaneous sites in the North Atlantic Slope basins, South Atlantic Slope, and Eastern Gulf of Mexico basins are presented. The data generally comprise a description of the station and tables showing the results of water quality measurements of the stream. The description of the station gives the location, drainage area, records available, and general remarks. Chemical quality, fluvial sediment, and water temperatures are listed. The chemical quality includes concentrations of individual dissolved constituents, hardness, specific conductance, and pH. Fluvial-sediment information is given for suspended-sediment discharges and concentrations. Water-temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. (Knapp-USGS)
W70-02115

CHART HOLDER USES OLD TYPEWRITER PARTS,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
Willie R. Curtis, and David N. Tolsted.
Agr Eng 48 (3): p 154-155, 1967.

Descriptors: *Hydrograph analysis, *Charts, *Hydrographs, *Data processing, Discharge measurement, Research equipment, Water measurement.

Describes a useful tool for use in converting streamflow hydrographs to amount of flow. Especially adapted to FW-1 water-level charts.
W70-02205

REQUIREMENTS FOR EFFECTIVE USE OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC) - DETERMINED BY FIELD EVALUATION, VOLUMES I and II,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 10.
W70-02235

REQUIREMENTS FOR EFFECTIVE USE OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC) - DETERMINED BY FIELD EVALUATION,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 10.
W70-02236

REQUIREMENTS FOR THE EFFECTIVE USE OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC) - DETERMINED BY FIELD EVALUATION. VOLUME III,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 10.
W70-02237

WATER RESOURCE OBSERVATORY SOLAR RADIATION DATA-WATER YEAR 1969 AND PRIOR.
Wyoming Univ., Laramie. Water Resources Research Inst.

Paul A Rechard - Coordinator. Available from the Clearinghouse as PB-188 287, $3.00 in paper copy, $0.65 in microfiche. Water Resources Series No 16, Oct 1969. 39 p, 1 tab, 1 fig. OWRR Project A-001-WYO.

Descriptors: *Solar radiation, *Data collections. Incident, reflected and absorbed solar radiation data from various locations operated by the University of Wyoming in and adjacent to Laramie, Wyoming are presented in tabular form. The period covered is from November 1966 to October 1969.
W70-02242

NON-LINEAR PROGRAMMING AS A METHOD OF DESION OF TREATMENT FACILITIES FOR COMBINED SEWER EFFLUENT,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05D.
W70-02243

SEDIMENT PARAMETERS AND ENVIRONMENT DISCRIMINATION: AN APPLICATION OF MULTIVARIATE STATISTICS,
Toronto Univ. (Ontario); and Scarborough Coll., Toronto (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 02J.
W70-02303

STREAM EQUATIONS AND METHOD OF CHARACTERISTICS,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05A.
W70-02326

THERMAL MODIFICATION OF RIVER WATER QUALITY,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
R. T. Jaske.
Sixth Biennial Hydraulics Conference, Pullman, Washington, Oct 18, 1967. Mss 16 p, 7 fig, 4 ref.

Descriptors: *Temperature, *Heat, *Temporal distribution, *Columbia River basin, Seasonal, Reservoirs, Temperature control, Statistical methods, Least squares method.

The influence of reservoirs on water quality below them was demonstrated in the Columbia River. The river temperature data were evaluated statistically using the formula T= A+ B sin (Cd+ D) using a digital computer. The analysis resulted in the following conclusions by the author: (1) The erection of hydraulic power dams and reservoirs on the Columbia River has had only a nominal effect on the annual mean temperature of the entire system. This change is less than one degree C. (2) The erection of these projects has significantly altered the timing of the annual temperature and has to a limited extent altered the seasonal extremes. (Novotny-Vanderbilt)
W70-02408

08. ENGINEERING WORKS

8A. Structures

DETERMINING PRESSURE SEALING CAPACITY OF PIPE GASKETS,
American Pipe and Construction Co., Monterey Park, Calif.
Gordon G. Robertson.
J Amer Water Works Ass, Vol 61, No 7, p 339-342, July 1969. 4 p, 6 fig, 1 tab, 2 ref.

Descriptors: *Gaskets, *Shear stress, Test procedures, Pressure pipes, Pressure, Deformation, Pipes, Pipelines, Stress distribution, Failures shear strength, Concrete pipes, Ultimate tensile strength, Steel pipes, Gaskets.
Identifiers: *O-ring seals, *Pipe joints, Test results, Cast iron pipe.

Circular cross-section rubber gaskets called O-rings have a long history of operation as sealing elements in pressure pipe joints. The sealing action is dependent on contact pressure between the gasket and mating surface. Measurements of gasket contact pressure indicate that an arch-shaped pressure distribution exists across the gasket contact area, and that the peak contact pressure always exceeds the applied hydrostatic pressure. The seal cannot leak as long as the gasket remains within its groove and maintains its structural integrity. Determining stress within a confined circular gasket under pressure is a complex procedure. M. G. Sotenskii's equation for calculating the pressure at which shear failure will take place is presented. One simplified approach uses limited scope testing for stress measurements. Guidelines for application to design problems are discussed. (USBR)
W70-02133

THE SEISMIC EVENTS AT KOYNA DAM,
California Inst. of Tech., Pasadena.
G. W. Housner.
Pap, Calif Inst Tech, Pasadena, May 1969. 25 p, 9 fig, 1 tab, 23 ref.

Descriptors: *Earthquake engineering, *Earthquakes, *Dams, Engineering geology, Concrete dams, *Reservoirs, Seismic design, *Seismology, Faults (Geology), Seismic studies, Geology, Geophysics, Foreign projects, Shear stress, Bibliographies, Hydrostatic pressure, Accelerographs, Water pressure, Seismographs.
Identifiers: Earthquake damage, Dam stability, *Seismic sources, Koyna Dam, India, Seismic stability, Tectonic loads.

Filling Koyna Dam reservoir in Peninsular India was accompanied by numerous micro-earthquakes followed by more than a dozen other quakes having magnitudes greater than 5.0. The greatest shock, with a magnitude of 6.5, caused significant damage to the dam and adjacent town. These seismic events occurred in a region supposedly very stable with very low seismicity, and have practical implications for geologists and engineers. Water in the reservoir very likely triggered the swarms of microearthquakes that preceded and presumably triggered the greatest 6.5 shock. Whether the triggering is attributable, however, to an increase in gravitational stresses, an increase in water pressure, or both, is not clear. A region considered to be very stable and having very low seismicity can contain volumes of rock having tectonic stresses sufficiently large to produce destructive earthquakes. The fact that Koyna Dam survived a measured 50% g acceleration when it was designed for 5% g indicates that conventional equivalent static design methods are not realistic. (USBR)
W70-02146

ECONOMIC DECISION FRAMEWORK FOR THE EFFICIENT USE OF DATA SOURCES,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 07B.
W70-02271

DEVELOPMENT OF SYSTEMS FOR GROUNDWATER RECHARGE INTO THE OGALLALA FORMATION,
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 04B.
W70-02282

8B. Hydraulics

HYDRAULICS OF LARGE BED ELEMENT CHANNELS,
Utah State Univ., Logan. Coll. of Engineering.
Harl E. Judd, and Dean F. Peterson.
Utah Water Res Lab Rep PRWG 17-6, Aug 1969. 115 p, 61 fig, 10 tab, 31 ref, 2 append.

Descriptors: *Open channel flow, *Alluvial channels, *Turbulent flow, *Roughness (Hydraulic), Fluid friction, Sediment transport, Dunes, Sand waves, Model studies, Hydraulic models, Flow re-

sistance, Dimensional analysis, Sedimentation, Hydraulics.
Identifiers: Large bed elements (Hydraulic).

Theoretical means of characterizing size, size distribution, spacing, and shape of bed elements are discussed in hydraulically significant terms for large bed element streams; these are related to flume experiments using simulated beds. Observed bed and flow characteristics are reported for a number of natural-stream study sites and the effect of roughness, depth, and slope on flow characteristics of natural streams are analyzed. Possibilities for use of large bed elements in open channel design are suggested. Large elements, derived from valley walls or ancient fluvial or glacial action are moved, if at all, only under conditions of extreme flood. Unlike those in finer sediments, the beds of such streams remain relatively fixed between major flood events and, most of the time, transport of sediments is small. With large relative roughness heights the commonly accepted logarithmic velocity distribution does not apply. Though relatively little attention has been given to flow characteristics in streams in the last two groups, the existence of such streams is common. (Knapp-USGS)
W70-02070

HYDRAULIC EQUIVALENCE OF MINERALS WITH A CONSIDERATION OF THE REENTRAINMENT PROCESS,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 02J.
W70-02074

A PROGRAM TO CALCULATE THE CHANGES OCCURRING IN THE BOTTOM AND THE WATERSHED OF A RIVER CARRYING A BED LOAD (FRENCH),
Bundesanstalt fuer Wasserbau, Karlsruhe (West Germany).
Karl Felkel.
English summary. 22nd Int Navigation Congr, Paris, Sec 1, Inland Navigation, Subj 5, p 5-23, 1969. 19 p, 7 fig, 5 tab, 5 ref.

Descriptors: *Sediment transport, *Bed load, *Computer programs, Streambeds, Rivers, Equations, Mathematical models, Programming languages, Engineering structures.
Identifiers: Meyer-Peter and Muller formula, Bed-load transports.

The bottom and water level changes occurring in rivers with bed loads can be calculated by a method using numerous consecutive small distances and intervals of time. The basic equations for such a computer program are briefly discussed. The bed-load balance of each of the river stretches is used for calculating the rising or deepening of the bottom during the selected time interval. The mathematical model is restricted to the calculation of the bed-load transport as a result of natural current. The Meyer-Peter and Muller formula of bed-load transport was used. The sequence of calculations is presented in a detailed structure diagram. The computer program written in ALGOL language is given. (Carstea-USGS)
W70-02103

PROBLEMS OF BED LOAD TRANSPORT IN FRENCH WATERWAYS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
Cl. Gemaehling, and J. Cl. Lebreton.
English summary. 22nd Int Navigation Congr, Paris, Sec 1, Inland Navigation, Subj 5, p 25-49, 1969. 25 p, 6 fig, 1 tab, 22 ref.

Descriptors: *Discharge measurement, *Bed load, *Channels, *Sediment transport, River training, River beds, Dams, Channel erosion, Suspended load, Reservoirs, Discharge (Water), Diversion structures, Aggradation, Analytical techniques, Tracers, Tracking techniques.
Identifiers: Montelimar reservoir.

River training works have brought new problems on channel stability, sediment transport, river bed degradation below dams, upstream aggradation, etc. The mechanisms of bed-load transport and the formulae to compute the maximum bed load are reviewed. In particular, the nuclear techniques are very useful in calculating the rate of bed load. Channel transitions such as junctions and expansions at port entrances, sediment transport (bed load and suspended load) following construction of control dams and diversion canals are discussed. Nomographs relating the river discharge (Q) to reservoir discharge (q) and reservoir level are useful during floods. This diagram makes it possible to ascertain how flow rates at every location on the retained reach have been affected by structural development. (Carstea-USGS)
W70-02104

SAND TRANSPORT STUDIES RELATED TO THE CANALIZATION OF THE LOWER RHINE,
Netherlands Rijkswaterstaat, Arnhem; and Waterloopkundig Laboratorium, Delft (Netherlands).
R. P. Sijbesma, M. De Vries, and A. Zanen.
French summary. 22nd Int Navigation Congr, Paris, Sec 1, Inland Navigation, Subj 5, p 51-64, 1969. 14 p, 10 fig, 1 photo, 1 tab, 6 ref.

Descriptors: *Channeling, *River regulation, *Sediment transport, Sands, Navigation, Locks, River beds, Hydraulic models, Streamflow, Sediment load, Bed load, Mathematical models, Sediment discharge.
Identifiers: *Lower Rhine River, Netherlands, Meyer-Peter and Muller formula.

Shortly after crossing the German border into the Netherlands, the Rhine divides twice: first near Pannerden in the Waal and in the Pannerden Canal and second at Westervoort into the Lower Rhine. The Lower Rhine should be canalized in order to improve navigation. One of the most important aspects of the contemplated improvements was the stability of the river beds following the canalization works. The Meyer-Peter and Muller formula was used in computation of sediment transport. The investigation also involved: (1) the construction of hydraulic models of the river bifurcations for experimental tests on the division of water and sand flows of various rates; (2) mathematical models for treating the results of the hydraulic models and (3) other partial hydraulic models for individual structures. (Carstea-USGS)
W70-02105

THE INFLUENCE OF EROSION BELOW CHUTES ON THE CONDITIONS OF NAVIGATION (FRENCH),
Institut d'Armenagement et d'Economie de l'Eau, Warsaw (Poland).
M. Z. Kornacki.
English summary. 22nd Int Navigation Congr, Paris, Sec 1, Inland Navigation, Subj 5, p 65-73, 1969. 9 p, 5 fig.

Descriptors: *Erosion, *Chutes, *Navigation, River training, River beds, Downstream, Slopes, Sands, Gravels, Flow, Dams, Streamflow, Hydraulics.
Identifiers: *Poland, Vistula River, Oder River.

Investigations are being carried out in Poland on changes occurring in river beds and on conditions of free flow below improvement works. In particular, studies were conducted below 4 dams on the Vistula and Oder Rivers. The navigation conditions downstream from the fall of a low sill were improved by the training works. The river bed was composed of sandy and gravelly formations and the slopes ranged between 0.25 and 0.32 parts per thousand. (Carstea-USGS)
W70-02106

SEDIMENTATION AND SEDIMENTATION PROBLEMS OF THE MONDEGO RIVER,
Direccao Geral dos Servicos Hidraulicos, Lisbon (Portugal); and Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
J. F. Ferreira, and L. V. Cunha.
French summary. 22nd Int Navigation Congr, Paris, Sec 1, Inland Navigation, Subj 5, p 75-106, 1969. 32 p, 26 fig, 12 ref.

Descriptors: *River regulation, *Floods, *Engineering structures, Flood protection, Irrigation, Hydroelectric power, Navigation, Dams, River beds, Sedimentation, Erosion, Bed load, Suspended load, Sediment discharge, Mathematical models, Hydraulic models.
Identifiers: *Portugal, Mondego River, Meyer-Peter and Muller formula, Einstein formula.

The Mondego River, Portugal is to be regulated to protect against floods, to provide irrigation facilities for 44,000 ha, to increase hydroelectric power, and to improve conditions of navigation. These purposes are served by two dams located in the upper catchment area. Particular care had to be exercised to insure stability of the river bed and thus to avoid sedimentation or erosion. Bed load and suspended load were measured at Coimbra and Villa Pouca over a number of years. The Meyer-Peter and Muller, and Einstein formulae were used for computations. The sediment discharge measured at Villa Pouca represents 40% of the sediment reaching Coimbra. The river bifurcation and the tributaries below Coimbra complicate the project. Mathematical and physical models were constructed to cope with these problems. (Carstea-USGS)
W70-02107

CANAL SHOALING STUDIES,
Corps of Engineers, Vicksburg, Miss.
Ernest B. Lipscomb, and John J. Franco.
French summary. 22nd Int Navigation Congr, Paris, Sec 1, Inland Navigation, Subj 5, p 107-121, 1969. 15 p, 5 fig, 1 tab, 8 ref.

Descriptors: *River training, *Channel improvement, *Sedimentation, *Erosion, *Bed load, Channels, Locks, Engineering structures, Dredging, Missouri River, Mississippi River, Sediment discharge, Streams, Model studies, Hydraulic models.
Identifiers: *Arkansas River, Training structures.

Shoaling problems in regulated rivers can be expected at mouths of tributaries, in crossings, in long straight reaches or in long flat bends where the channel tends to be unstable, and in lock approaches. Some maintenance dredging will be required in most waterways where there is sediment moving into or within the waterway. Maintenance dredging appears to be the only practical solution in the lower lock approach. The problem of bed-material load at the mouths of tributary streams can be solved by the proper application of the dominant discharges in the design of the channel and by training structures. Some of the problems experiences on the Missouri River and the Upper Mississippi River and those investigated in model studies conducted in connection with the development of navigation on the Arkansas River are discussed. Model studies are effective means of investigating many of sedimentation and sonar problems. (Carstea-USGS)
W70-02108

MODEL STUDY FOR THE PREVENTION OF SHOALING AT THE ENTRANCE AND EXIT OF ATHER-EL-NABI NAVIGATION CHANNEL.
Ministry of Irrigation (Egypt). Delta Barrage.

French summary. 22nd Int Navigation Congr, Paris, Sec 1, Inland Navigation, Subj 5, p 123-136, 1969. 14 p, 13 fig, 3 tab.

Descriptors: *Model studies, *Shoals, *Navigation, *Canals, Hydraulic models, Sediments, Sedimentation, Deposition (Sediments), Erosion, Flow profiles, Dredging, Prototype tests, Sands.
Identifiers: *Ather-El-Nabi channel, Nile River, Shoal prevention.

A model test was made of the Ather-El-Nabi Ship Canal, Eastern Branch of the Nile, for solving

problems of sediment deposition at the bifurcation and at the point of re-entry into the Nile. The experiment was undertaken to investigate the best alignment for the canal's entry, the flow pattern at the exit and deposition and erosion in the canal itself. The best scale for the proper representation of prototype conditions was found to be 1:100 horizontal and 1:50 vertical. Several experimental runs were conducted to find the best alignment for the entrance. Shoals are likely to recur so dredging may still prove necessary. (Carstea-USGS)
W70-02109

ANALYTICAL SOLUTION FOR TURBULENT FLOW IN PIPES,
Universidad Central de Venezuela, Caracas.
A. Zagustin, and K. Zagustin.
La Houille Blanche, No 2, p 113-118, 1969. 6 p, 3 fig, 2 ref, append.

Descriptors: Turbulence, *Turbulent flow, *Pipe flow, Fluid mechanics, *Closed conduit flow, Foreign research, Steady flow, Hydraulics, Fluid flow, *Velocity distribution.
Identifiers: Venezuela, Prandtl theory, Von Karman method, Mixing length, Karman constant.

An equation is presented for the analytical solution of turbulent flow in a smooth pipe. The solution is obtained without making empirical or semi-empirical assumptions on the mixing length distributions, as is done in the theories of Prandtl and Von Karman. The proposed method is developed from a balance of pulsation energy equation, representing the balance between the rate of energy lost because of molecular motion and the flux of turbulent energy produced at the wall. The method shows excellent agreement with experimental results at the neighborhood of the wall and throughout the pipe. The final expressions depend on only one experimental constant, the Karman universal constant Graphs are presented, using the standard accepted value of Karman's constant as 0.40; using a slightly lower value of 0.395 or 0.39 gives even better agreement with experiments. The expression for velocity distribution coincides with Darcy's empirical formula of 1885 at the centerline, and with Prandtl's expression at the neighborhood of the wall. (USBR)
W70-02136

MECHANICS OF BED FORMATIONS,
Robert Coll., Istanbul (Turkey).
F. Senturk.
La Houille Blanche, No 2, p 163-172, 1969. 10 p, 17 fig, 2 tab, 8 ref.

Descriptors: Sands, *Sand waves, Sediments, *Streambeds, Beds, Under water, Dunes, Channel flow, Hydraulics, Hydraulic models, *Flow resistance, Hydraulic radius, *Configuration, Fluid mechanics, Foreign research.
Identifiers: *Bed movements, Bed profiles, *Bed resistance, Turkey, *Bed ripples, Bed roughness, Rippled surfaces, Channel beds.

The bed formation mechanics of nonuniformly sized sand are examined. Hydraulic conditions can be defined for a state of flow under which sand particles do not move. A further range of conditions exists were sand grains are in motion but do not develop sand configurations. Above a limit, particle movements are accentuated and bed configurations develop rapidly. The formation of ripples, antiripples, dunes, and antidunes is discussed. Grain size has a direct influence on the increase in flow resistance as the bed changes from a plane form to a wavy form. Bed configurations move much more rapidly than individual sand particles. The difference in velocity between sand grains and the movement of configurations causes the change in wave forms. Resistance of the bed to flow is a function of bed configuration and can be classified into 4 types of resistance characteristics according to bed configurations. (USBR)
W70-02149

EFFECT OF RAINFALL ON THE VELOCITY DISTRIBUTION AND TRACTIVE FORCE IN A TRIANGULAR OPEN CHANNEL,
Mississippi State Univ., State College; and Auburn Univ., Ala.
E. Dale Threadgill, and Ronald E. Hermanson.
Trans Amer Soc Agr Eng, Vol 12, No 3, p 352-355, May-June 1969. 4 p, 2 fig, 3 tab, 13 ref.

Descriptors: *Rainfall, *Velocity distribution, Bank erosion, Sensors, *Tractive forces, *Open channels, Laboratory tests, Stream erosion, Hot film anemometers, Hydraulics, Shear forces, Rainfall intensity, Rainfall simulators, Sediment transport, Instrumentation.
Identifiers: Velocity gradient, Prandtl-Von Karman equation.

A study was made to determine effects and significance of rainfall on the velocity distribution and tractive force in a shallow channel having a cross section approximating that of a natural channel. Simulated rainfall at intensities of 5, 12, and 20 iph was applied to the flow in a shallow, triangular channel. Conclusions were: (1) vertical velocity distribution is logarithmic with and without rainfall; (2) rainfall significantly reduced the velocity of flow throughout the entire cross section with the magnitude of this effect decreasing with decreasing rainfall intensity; this effect was more pronounced for flow over rough boundaries; (3) rainfall had no significant effect on the vertical velocity gradient; (4) rainfall caused a decrease in tractive force in the deeper regions of flow and an increase in tractive force in the shallow regions, but the magnitudes of these effects were not significant; (5) the Prandtl-Karman expression should not be identical for the velocity distribution near rough and smooth boundaries when referred to average velocity; and (6) coefficients for the Prandtl-Karman velocity distribution equation were developed from pipe flow data, and did not apply for the velocity distributions studied. (USBR)
W70-02174

LOSS COEFFICIENT IN A CHANNEL BEND WITH NATURALLY DEFORMED BED,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
Christos Hadjitheodorou.
PB-188 509. Water Resources Res Inst Proj Completion Rep, Puerto Rico Univ, June 1969. 31 p, 7 fig, 13 ref, 1 append. OWRR Proj No A-011-PR.

Descriptors: *Turbulent flow, *Alluvial channels, *Meanders, *Open channel flow, *Energy losses, Waves (Water), Shear, Jets, Energy equation, Model studies, Hydraulic models, Mathematical models, Flow around objects, Friction, Head loss, Roughness (Hydraulic), Hydraulics.
Identifiers: *Flow loss.

Energy losses in meandering streams were studied with flumes with movable beds and analyzed mathematically. With a movable bed, energy loss is greater than with a fixed bed because of the formation of point bars at the inside of bends. These bars increase the loss by acting as obstacles to flow. Channel shear stress is increased, turbulence is increased, flow separation may further increase the loss, and waves are formed which increase loss by wave drag. Data are presented as plots of Froude numbers vs loss coefficients. The analytical solution uses the theory of ideal jet flow, in which gravity is the predominant force and surface waves are neglected. (Knapp-USGS)
W70-02287

CATALOG OF TSUNAMIS IN ALASKA,
Hawaii Univ., Honolulu; and Coast and Geodetic Survey, Honolulu, Hawaii.
For primary bibliographic entry see Field 02L.
W70-02289

METHODS FOR EVALUATING THE EFFECTS OF UPSTREAM FLOOD CONTROL MEASURES ON WATERSHED YIELD,
Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W70-02322

EXPERIMENTAL STUDY OF WARM WATER FLOW INTO IMPOUNDMENTS. PART I: FLOW AND HEAT EXCHANGE NEAR A SURFACE OUTLET IN TWODIMENSIONAL FLOW,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 02H.
W70-02393

EXPERIMENTAL STUDY OF WARM WATER FLOW INTO IMPOUNDMENTS. PART II: TEMPERATURE AND VELOCITY INSTRUMENTATION AND DATA PROCESSING FOR THE THREE DIMENSIONAL FLOW EXPERIMENTS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 02H.
W70-02394

EXPERIMENTAL STUDY OF WARM WATER FLOW INTO IMPOUNDMENTS. PART III: TEMPERATURE AND VELOCITY FIELDS NEAR A SURFACE OUTLET IN THREE-DIMENSIONAL FLOW,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 02H.
W70-02395

8C. Hydraulic Machinery

EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
Politekhnicheskii Institut, Leningrad (USSR).
L. P. Grianko, and V. G. Staritskii.
Trudy Leningrad Polytek Inst, No 297, p 63-67, 1968. Transl from Russ, Bur Reclam Transl 579, Aug 1969. 15 p, 6 fig, 5 ref, append.

Descriptors: *Hydraulic machinery, *Hydraulic turbines, Foreign design practices, Model tests, *Turbine runners, Laboratory tests, Cavitation, Efficiencies, Research and development, Mechanical engineering, Testing machines, Hydraulics, Surges, Turbulent flow, Discharge measurement, Hydraulic design, Foreign research.
Identifiers: USSR, Leningrad Poly Inst (USSR), Krasnoiarsk Powerplant (USSR), *Machine design, Comparative studies.

The Hydraulic Machinery Laboratory at Leningrad Polytechnic Institute, USSR, has developed a combined Francis and propeller runner to fit the operating conditions and dimensions of Krasnoiarsk Hydropowerplant. Models of 2 alternative designs of this runner were tested and data compared with that of Francis Runner RO-697 used at Krasnoiarsk. The only dimensional design change is that the flare angle of the lower band is 13 deg instead of the 20 deg of RO-697. Since specific speed and discharge capacity of the combined runner are significantly higher than for RO-697, using this runner at Krasnoiarsk would increase unit capacity at the generator to 580 mw and reduce the total number of units by one. Energy factors for the improved model design showed that efficiency was only 0.5 or 1% less than that of RO-697. Cavitational qualities were about equal. Pressure surges beyond the new runner were 30-40% lower than beyond RO-697, reducing turbulence in design operating conditions and also during startup at reduced heads. The greater discharge capacity of the combined runner will increase its operational reliability over that of RO-697. (USBR)
W70-02138

EFFECT OF MANUFACTURING TOLERANCES ON THE STRESS STATE OF RUNNERS FOR FRANCIS HYDRAULIC TURBINES,
A. Ia. Aronson, N. F. Berkhov, and E. M. Kagan.
Energomashinostr, No 4, p 32-33, 1969. Transl from Russ, Bur Reclam Transl 717, Aug 1969. 6 p, 1 fig, 2 ref.

Descriptors: *Hydraulic turbines, Hydraulic machinery, Manufacturing, Turbine runners, Turbine blades, Francis turbines, *Stress analysis, Mechanical engineering, Stress distribution, Stress, Graphical analysis, *Tolerances (Mechanics), Errors, Foreign research, Mathematics, Design data.
Identifiers: USSR, Krasnoiarsk Powerplant (USSR), Comparative studies, Aswan Dam (UAR), Machine design.

To assure reliability in manufacturing runners for large Francis hydraulic turbines, an accurate method of evaluating stress distribution in runner parts is necessary. Manufacturing quality, including deviations from permissible manufacturing tolerances, has an important effect on stress distribution. Six geometric dimensions from manufacturing data of Krasnoiarsk and Aswan blades were used for evaluating the effect of tolerances on the stress state of runners. Stress distribution was determined by the usual methods, and confidence areas were computed and plotted on a distribution curve. The maximum variation in stresses, caused by deviations from geometric dimensions in manufacturing, reached 10% for leading edges and 50% for trailing edges of Krasnoiarsk and 15% and 60% for Aswan. Manufacturing tolerances for Aswan were set by recomputing the Krasnoiarsk tolerances by a proportional ratio of runner diameters, but the relative tolerances of both runners had a confidence area differing by 1.5 to 2.0 times. The stress variation was not caused by geometrical dimensions but by geometrical characteristics, such as area or moments of inertia. Stress variations must be considered in evaluating runner strength. (USBR)
W70-02139

EXPERIMENTAL STUDY AND ANALYSIS OF DRAFT-TUBE SURGING,
Bureau of Reclamation, Denver, Colo.
J. J. Cassidy.
Bur Reclam Rep No HYD-591, May 1969. 31 p, 20 fig, 3 tab, 12 ref.

Descriptors: *Draft tubes, *Turbines, *Hydraulic turbines, *Surges, Hydraulics, Hydroelectric plants, Hydraulic machinery, Fluid mechanics, Dimensional analysis, Air, Unsteady flow, Pressure, Laboratory tests, Model tests, Fluid flow, Non-uniform flow, Reynolds number.
Identifiers: Fluid dynamics, Hydraulic resonance.

Draft-tube surge experiments were conducted with models of draft tubes, using air as the fluid. The occurrence, frequency, and amplitude of surges were correlated with flow and draft-tube geometry variables. Studies show that surges arise when angular momentum reaches a critical value relative to linear momentum. Surge frequency and peak-to-peak pressures are independent of viscous effects for Reynolds numbers above 80000, and are correlated with a dimensionless momentum parameter for a particular draft-tube shape. A criterion is given for predicting the surging threshold. Results of the study are applied to analyses of draft-tube surging in the Fontenelle and Hoover replacement turbines. (USBR)
W70-02157

EVAPORATION FOR DESALINATION,
Polytechnic Inst. of Brooklyn, N.Y.
For primary bibliographic entry see Field 03A.
W70-02158

STABILITY OF AC NETWORKS IN ASSOCIATION WITH HVDC INSTALLATIONS,
Brown, Boveri and Co. Ltd., Baden (Switzerland).
J. Kauferle, and E. Proll.
Brown Boveri Rev, Vol 56, No 3, p 112-120, Mar 1969. 9 p, 8 fig, 9 ref.

Descriptors: *Extra high voltage, *Alternating current, *Direct current, *Electrical stability, Electrical studies, Simulation, Errors, *Transmission (Electrical), Electric power, Faults (Electrical), Power factors, Foreign research, Differential equations, Electric generators, Oscillation, Oscillographs, Analog computers, Electrical networks.
Identifiers: Switzerland, *Transient stability, Interconnected systems.

Because of ease of control, an hvdc transmission system can be used to influence the stability of associated ac networks. To improve stability, appropriate signals derived from the network characteristics are fed into the hvdc control system. The manner in which an hvdc system, with and without means of improving stability, influences the steady-state and transient stability of an ac network is examined. The model system chosen for the investigation was an equivalent network, consisting of generator and passive load, supplying an infinite network via an ac line and a parallel hvdc link. The study considered the influence of the hvdc link on electromechanical oscillations between the 2 networks while varying the steady-state power distribution within broad limits. The primary concern was performance when small faults occur (steady-state stability). Effects created by short circuits on the ac tieline (transient stability) were also studied. (USBR)
W70-02171

8D. Soil Mechanics

GEOLOGIC STUDIES AT ARBUCKLE DAM, MURRAY COUNTY, OKLAHOMA,
Bureau of Reclamation, Sacramento, Calif.
For primary bibliographic entry see Field 08E.
W70-02131

STABILITY OF TOWER STRUCTURES WITH SHALLOW FOOTINGS ON SOIL,
G. K. Klein, and I. V. Gavrichenkova.
Soil Mech Found Eng, No 6, p 405-411, Nov-Dec 1968. 7 p, 6 fig, 4 ref.

Descriptors: *Towers, *Structural stability, *Stability, Foundations, *Footings, Moments, Bending, *Bending moments, Deformation, Deflection, Elastic deformation, Plastic deformation, Structural behavior, Pressure distribution, Structural design, Stress distrubution, Soil pressure, Foreign activities, *Transmission towers.
Identifiers: Rigid structures, Deformable soils, Reactive loads, USSR, Static behavior.

A structure may lose stability as a result of the combined action of moments and virials of forces acting on the structure reaching limiting values. Structures having rectangular, circular, and ring footings are considered for various cases of reactive pressure distribution in the soil under the footings. Relationships between limiting values of moments and limiting values of virials are developed for situations resulting from separate action and from combined action of moments and virials. Soil under the footings is assumed to be locally deformable. The structure is considered first to be absolutely rigid. After finding the angle of inclination for the rigid structure, the secondary moments and deformations caused by bending of the tower are determined by the method of successive approximations. Then the angle of inclination of the tower, allowing for deformation, can be found and the tower can be designed for stability. A sample problem shows that the influence of virials compared to axial compressive forces and bending moments is insignificant and, for design of rigid structures, can be disregarded. (USBR)
W70-02141

FEASIBILITY OF COLD WEATHER EARTHWORK,
Purdue University, Lafayette, Ind.
C. W. Lovell, Jr., and A. M. Osborne.
Joint Highw Res Proj, No 1, Purdue Univ, Lafayette, Ind, Feb 1968. 23 p, 6 fig, 2 tab, 14 ref.

Descriptors: *Earthworks, *Cold weather construction, *Cold regions, Construction, Frozen soils, Frost, *Excavation, Frozen ground, Winter, Compaction, Moisture content, Feasibility, Economics, Construction costs, Benefits, Annual costs, Personnel.
Identifiers: Low temperature, *Highway engineering.

Most earthwork operations are more costly during cold weather. However, the benefits of keeping construction forces and equipment continuously operative and advancing the completion date of a modern and safer facility may more than compensate for increases in unit costs. Cold weather earthwork experiences in the northern United States, the provinces of Canada, and the Scandinavian countries have been studied. The effort has served to define: (1) the manner in which winter weather and soil conditions tend to restrict construction season length; (2) design and construction practices that have been employed to cope with winter conditions; and (3) an estimate of relative unit costs for various winter operations. Advantages of cold weather earthwork have been defined in a simple linear economic model. An assessment of deterrents and benefits concludes that cold weather earthwork is economically and technically feasible on many highway projects in the frost area of North America. (USBR)
W70-02142

COMPACTION GROUTING TECHNIQUE AND OBSERVATIONS,
Pressure Grout Co., Daly City, Calif.
Edward D. Graf.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 95, No SM5, p 1151-1158, Sept 1969. 8 p, 4 fig.

Descriptors: *Compaction, *Grouting, *Foundations, *Soil compaction, Lift, Soil density, Settlement, Settlement (Structural), Differential settlement, Buildings, Equipment, Construction equipment, Construction materials, Mudjacking, Soil engineering, Soil mechanics, Radial stress.
Identifiers: Grouting pressure, Grout mixes, Leveling, Radial loads, Lifting devices, Empirical methods, Construction methods.

Compaction grouting is a specialized technique used for controlled densification of in situ soils at depth by displacing soil particles radially from a controlled, growing bulb of grout. Observations of many jobs have empirically established that compaction grouting is an effective and economic method of compacting most sands, silts, unsaturated clays, and organic materials. Major applications include underpinning and leveling structures that have suffered differential settlement. Theory, outline of basic techniques, equipment and materials, observations, and empirically derived conclusions are presented. (USBR)
W70-02165

THE MORPHOLOGY AND CHRONOLOGY OF A LANDSLIDE NEAR DILLON DAM, DILLON, COLORADO,
Colorado Univ., Boulder; and Geological Survey, Denver, Colo.
T. C. Nichols, Jr., and Ernest E. Wahlstrom.
Eng Geol Int J, Vol 3, No 2, p 149-174, Apr 1969. 26 p, 18 fig, 4 tab, 3 ref.

Descriptors: *Landslides, Slopes, Slope stability, Shear strength, Slope stabilization, Sliding, Geologic investigations, *Engineering geology, Clays, Weathering, *Petrographic investigations, Shear planes, Soil engineering, Swelling, Damsites, Expansive clays, Excavation.
Identifiers: Dillon Dam (Colo), Activation.

During construction of Dillon Dam in 1960, excavation at the left abutment cut the toe of an old, relatively stable landslide reactivating the slide. The slide threatened to bury the intake structure and portal of the outlet tunnel. Landslide investigations included laboratory and field analysis of the mineralogy, chemistry, and physical properties of the landslide materials and bedrock formations. The investigations provide an understanding of the relative importance of the factors contributing to the origin and reactivation of the landslide. The landslide occurred in overburden resting on the Morrison Formation. Landslide materials consisted of angular fragments of quartzite and sandstone from the Dakota Formation, embedded in very fine-grained to colloidal clayey substances derived mainly from the upper, noncalcareous portion of the Morrison Formation. Remedial measures included excavating a large volume of landslide material and constructing a gravelfill cofferdam on bedrock at the toe of the landslide. (USBR)
W70-02172

THE PARTICLE SIZE SCALE,
Florida State Univ., Tallahassee.
William F. Tanner.
J Sediment Petrology, Vol 39, No 2, p 809-812, June 1969. 4 p, 8 ref.

Descriptors: *Grain sizes, Granular materials, Granules, Gravels, Sands, Silts, Clays, Fines, Sieve analysis, *Size, Scale, Particles, *Particle size, Logarithms, Classification, Geology, Soil science, Civil engineering, Highways, Engineering geology, Soil engineering.
Identifiers: Fineness, Size frequency distribution, Particle diameter.

The Grain Size Study Committee of the Society of Economic Paleontologists and Mineralogists reports the position taken by geologists on particle size scales and nomenclature. The committee recommends the phi scale (negative base 2 logarithm of particle diameter in mm). Advantages of the phi scale are: (1) evenly spaced division points; (2) geometric basis; (3) simple subdivision of spacing to any desired precision; (4) wide range of sizes extending to any extreme; (5) widespread acceptance; (6) approximate coincidence of major dividing points with natural size classifications; (7) ease of use in probability analysis; (8) ease of use in computing statistical parameters; (9) amenable to nonadvanced analytic methods; (10) fairly close approximation to most other scales; and (11) commercially available phi-size screens. No other scale matches this list; most scales do not have more than 3 or 4 of these advantages. Positions taken by engineers and soil scientists of other societies taking part in the project are summarized; the consensus is that too much has been invested in the currently used systems to effect many significant changes. (USBR)
W70-02173

ACIDITY AND PLANT-AVAILABLE PHOSPHORUS IN STRATA OVERLYING COAL SEAMS,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04D.
W70-02208

SPOIL BANK STABILITY IN EASTERN KENTUCKY,
Forest Service (USDA), Berea, Ky. Northeastern Forest Experiment Station.
Weldon K. Weigle.
Mining Congr J, 52 (4): p 67-73, 1966.

Descriptors: *Strip mines, *Soil mechanics, *Landslides, *Appalachian mountain region, Kentucky, Coal mines, Spoil banks, Soil classifications, Soil strength, Compressive strength, Slope stability.

A survey of contour type strip mining in the mountainous terrain of eastern Kentucky showed 12 percent of spoil outslopes to be in mass failures. This study of spoils at 17 slides in four eastern Kentucky counties showed soil classification variations from sandy silt to clayey silt, a range of 0-10 plastic index, bearing capacity from 1,400 lb. per sq. ft. when dry to almost zero when wet, average densities ranging from 71 to 90 lb. per cu. ft. and a mean unconfined compression of 700 lb. per sq. ft. Stability was computed by Terzaghi's modification of the method of slices based upon a safety factor of unity. A chart relating safe fill bench width to natural slope steepness was presented. The effect of moisture upon spoil stability was recognized. The difference between the measured depth of tension cracks and the depth computed by use of Hcr= 2c/w was held to be due to the spoil not behaving as a truly cohesive material. (Williams-Forest Service)
W70-02210

8E. Rock Mechanics and Geology

GEOLOGIC STUDIES AT ARBUCKLE DAM, MURRAY COUNTY, OKLAHOMA,
Bureau of Reclamation, Sacramento, Calif.
Joe L. Jackson.
Bull Ass Eng Geol, Vol 5, No 2, p 79-99, Fall 1968. 21 p, 4 fig, 2 tab, 11 ref.

Descriptors: Earth dams, Dam foundations, *Foundation investigations, Abutments, *Damsites, *Engineering geology, Geologic investigations, Grout curtains, *Grouting, Riprap, Aggregates, Watertight, Structural geology, Faults (Geology).
Identifiers: Grout take, Arbuckle Dam (Okla), Rock competency.

Arbuckle Dam, a 142-ft-high earthfill dam on Rock Creek near Sulfur, Okla., is on the north flank of the Arbuckle uplift. Complexly folded and faulted Paleozoic shale and limestone in the left abutment and foundation area abut unconformably overlapping Late Pennsylvanian conglomerate in the right abutment. Preconstruction geologic investigations indicated that the foundation was competent and essentially watertight. Because of the geologic complexities at the site, design engineers were apprehensive of the interpretations of the geologists, principally regarding the competence and watertightness of the foundation site. The designers' distrust of the geologists' interpretation resulted in a significant overestimate of the grouting requirement and and a substantially higher grouting cost than would have been required. During construction, the geologic interpretations were found to be essentially correct. Geologic judgment was a challenging but necessary part of preconstruction studies for Arbuckle Dam. The experience points out the value of carefully applied interpretations for the engineer and the engineering geologist. (USBR)
W70-02131

APPROACH TO CLASSIFYING ROCK FOR TUNNEL LINER DESIGN,
California State Dept. of Water Resources, Sacramento.
G. H. Kruse, K. L. Zerneke, and J. B. Scott.
Prepr, 11th Symp Rock Mech, Berkeley, Calif, June 1969. 32 p, 12 fig, 2 tab, 10 ref.

Descriptors: *Pressure tunnels, *Tunnel design, Tunnels, *Engineering geology, *Tunnel linings, *Steel linings, Rock excavation, Deformation, *Rock mechanics, Rock properties, Joints (Geology), Stress relieving, Underground structures, *Classification, Extensometers, Stress analysis, Faults (Geology), Geologic investigations.
Identifiers: Rock competency, Rock tests, Plate bearing tests, In situ tests, *Deformation modulus, Tehachapi Crossing, Calif.

A rock classification system was developed for determining the in-place deformation modulus of pressure tunnel rock at the A D Edmonstron Pumping Plant Discharge Lines, Calif. The rock classification, based on visual geological examination, gives a numerical rating for rock type, condition of rock, joints, and shear zones. The classification system must be referenced to a suitable program of in situ rock testing and to the design criteria for structural elements requiring support from the rock. The development of the visual classification system, use of the system in conjunction with in situ rock tests and seismic velocity measurements, and an appraisal of the application of the method to pressure tunnel design are discussed. Rock testing included plate bearing tests, borehole stress relief, and measurement of tunnel relaxation as tunnel excavation advanced. Seismic velocity was measured by a portable hammer-type seismic timer instrument. Rock quality according to this system is defined by numerical values that are constant and have the same meaning to geologists and engineers. The classification system provides a refined evaluation of the load-bearing quality of the rock. (USBR)
W70-02145

THE SEISMIC EVENTS AT KOYNA DAM,
California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 08A.
W70-02146

CHARACTERISTICS OF ROCK MOTIONS DURING EARTHQUAKES,
California Univ., Berkeley; and Utah State Univ., Logan.
H. Bolton Seed, I. M. Idriss, and Fred W. Kiefer.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 95, No SM5, p 1199-1218, Sept 1969. 20 p, 21 fig, 41 ref, 2 append.

Descriptors: *Earthquakes, *Motion, *Earth movements, *Rocks, *Seismology, Earthquake Engineering, Frequency, Accelerating, Geologic formations, Evaluation, Faults (Geology), Rock mechanics, Soil mechanics, Attenuation, Damping, Bibliographies, Seismic studies, Seismographs.
Identifiers: *Magnitude, Shakers, Acceleration (Mechanical), Epicenters, Dynamic response, Acceleration pattern, El Centro, Calif.

Procedures are given for evaluating probable motion characteristics of rock formations during earthquakes. Rock motions are characterized in terms of maximum amplitude of accelerations, predominant period of motions, and duration of motions. The characteristics depend mainly on the magnitude of the earthquake and distance of the site from the zone of energy release. Available data relating rock motion characteristics to the magnitude of the earthquake and the distance to the causative fault are used to establish a general procedure for assessing the maximum acceleration, predominant period, duration of shaking, and time history of accelerations developed during any given earthquake. As an example, rock motions at the El Centro, Calif site (1940 El Centro earthquake) are estimated using the proposed procedure and incorporated in analyses of the response of the site. Computed surface motions agree with those recorded during the 1940 El Centro earthquake. (USBR)
W70-02159

THE APPLICATION OF ENGINEERING GEOLOGY IN THE REGIONAL DEVELOPMENT OF NORTHERN AND CENTRAL IRAN,
Imperial College of Science and Technology, London, (England).
P. G. Rookes, and J. L. Knill.
Eng Geol Int J, Vol 3, No 2, p 81-120, Apr 1969. 40 p, 33 fig, 4 tab, 14 ref.

Descriptors: *Engineering geology, Foreign construction, Mountains, Foreign projects, *Deserts, Arid climates, *Arid lands, Reservoir sites, Dam foundations, Semiarid climates, Semiarid land, Reservoirs, Reservoir silting, Dams, Tunneling, Earthquakes, Road construction, Construction materials, Groundwater, Groundwater geology, *Geologic investigations.

Identifiers: Iran, Engineering works, Earthquake damage.

Engineering geology plays a useful part in planning and executing engineering developments in arid countries. The engineering geologist forms a part of a team contributing to the identification and solution of engineering problems. The application of engineering geology to regional development of semiarid and arid areas in Iran is discussed. The geology of Iran is outlined; engineering problems encountered under varied geologic conditions in mountain ranges and in different zones of wide desert plains are discussed. Examples demonstrate the application of engineering geology for reservoir construction, reservoir silting, tunneling, earthquake investigations, road construction, selection of materials, and groundwater development. Contributions of the engineering geologist to engineering development are probably more important in arid regions than in most other climatic zones. (USBR)
W70-02162

FORECASTING THE REWORKING OF KARSTIC SHORES OF RESERVOIRS COMPOSED OF SULFATE ROCKS,
I. A. Pecherkin.
Hydrotech Constr, No 12, p 1060-1063, Dec 1968. 4 p, 3 fig, 1 tab, 1 ref.

Descriptors: *Reservoirs, *Shores, *Solubility, *Gypsum, *Karst, Rock properties, Reservoir surveys, Anhydrite, Calcium sulfate, Deterioration, Foreign research, Geologic investigations, Engineering geology.
Identifiers: *Rock dissolution, *Shore reformation, Kama Reservoir, USSR/USSR, Shoreline development, Soluble rocks, Solution rate.

The shores of reservoirs on karstic sulfate rock are continually being destroyed with unabating intensity. Rocks directly at the waterline are dissolved, niches are formed, blocks cave in, and the caved rock is dissolved. As the exposed rock comes into contact with the waves, conditions are readied for renewed caving. The solution of gypsum also occurs below the water surface. Destruction of karstic shores is fundamentally different than reworking nonkarstic sand and gravel shores; reworking nonkarstic shores abates gradually as shores develop and the inshore shoal is formed. The destruction of karstic shores is caused by solution of the rock; shoals are not formed and the shore remains deep, maintaining the rate of rock dissolution. Observations of shore destruction at Kama Reservoir, USSR, show a linear rate for shore recession over many years, with periods of rest and active shore retreat. Equations are given for predicting the rate of shore retreat and for calculating the volume of caved and, subsequently, dissolved rock. Calculations of the volume of caved rock and the rate of rock dissolution can give approximations of the periods of rest and destruction. (USBR)
W70-02166

GEOTECHNICAL ASSESSMENT OF A SITE AT MUNDFORD, NORFOLK, FOR A LARGE PROTON ACCELERATOR,
Building Research Station, Watford (England); and Institute of Geological Sciences, London (England).
W. H. Ward, J. B. Burland, and R. W. Gallois.
Bldg Res Sta Curr Pap, CP 3/69, p 399-431, Mar 1969. 37 p, 30 fig, 6 tab, 3 ref, 2 append.

Descriptors: *Sites, Rock properties, *Rock foundations, Tunnels, Rock mechanics, *Chalks, Underground structures, Subsurface investigations, Engineering geology, Geologic investigations, Deformation, *Field tests, Auger borings, *Foundation investigations, Foundation rocks, Field investigations.
Identifiers: *In situ tests, Rock tests, Underground openings, In situ rock, Foreign testing, Great Britain, Loading tests, Plate load tests.

A proposed site for a 300-GeV proton accelerator at Munford, England, was evaluated and shown to be geotechnically acceptable. The large accelerator has very stringent requirements for ground stability and deformation under load that are foreign to normal civil engineering experience and practice. The investigation represents a new approach to the evaluation of a large site on soft rock; the method is based on large-scale field work, without recourse to laboratory testing that often proves unsatisfactory. The rock (chalk) was classified into 5 grades according to features likely to influence load deformation behavior. The rock was described in situ by visual examination in man-sized auger holes. Load deformation was measured directly in the field by full-scale water tank loading tests and by plate loading tests. Field investigation procedures and results are discussed. (USBR)
W70-02170

8F. Concrete

FIELD TESTS OF CRACK AND JOINT SEALING COMPOUNDS IN CONCRETE CANAL LININGS--INTERIM REPORT,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08G.
W70-02137

SOIL-CEMENT LININGS FOR WATER-CONTAINING STRUCTURES,
Portland Cement Association, San Francisco, Calif. Western Region.
E. H. Rogers.
US Department of Agriculture, Agricultural Research Service, ARS-41-147, p 94-105, Apr 1969. 12 p, 2 fig, 5 photo, 1 tab, 8 ref.

Descriptors: *Soil cement, *Linings, Leakage, Reservoir leakage, Seepage.

Soil-cement has been used successfully as a low-cost lining material for water-containing structures for over 20 years. The more important applications include linings for domestic water supply reservoirs, farm irrigation ponds, sewage lagoons, and manmade lakes. Soil-cement is not intended to replace concrete, which remains the material best suited for permanent linings. But, for the many structures for which a concrete lining is not economically feasible, perhaps becuase of a short design life or inadequate financing, a soil-cement lining can provide an economical solution. The engineering technology of soil-cement is well understood today as a result of extensive research and wide application in road construction extending over a period of more than 30 years. Physical and chemical properties of soil-cement are predictable and controllable with the application of well-defined engineering techniques. A wide variety of construction equipment is available to mix and place soil-cement for both small and large projects. Procedures for soil-cement construction are uncomplicated and as easily adapted for the construction of lining for a small farm reservoir as to that for a multimillion-gallon-capacity reservoir.
W70-02281

8G. Materials

FIELD TESTS OF CRACK AND JOINT SEALING COMPOUNDS IN CONCRETE CANAL LININGS--INTERIM REPORT,
Bureau of Reclamation, Denver, Colo.
H. Johns.
Bur Reclam Rep No ChE-67, June 1969. 63 p, 22 fig, 9 tab, 2 ref, append.

Descriptors: *Sealing compounds, *Joints, *Contraction joints, *Joint fillers, Plastics, Concretes, Adhesion, Mastics, Erosion, Canal linings, Durability, Cohesion, Consistency, Abrasive blasting, Elastomers, Idaho, Specifications, *Sealants, Field investigations, Field tests, *Cracks, Sun.
Identifiers: New York Canal (Idaho), Deaver Canal (Wyo), Canal sealants, St. Vrain Supply Canal (Colo), Product evaluation.

Field tests of sealing materials for random cracks and contraction joints in 3 concrete-lined canals are reviewed. Exposure periods vary from 2 to 10 yr.; environments vary from a mild northern climate to a severe northern climate. Tests indicate that: (1) coal tar extended polysulfide sealants conforming to Bureau of Reclamation canal sealant specifications and the glass cloth reinforced asphalt mastic tape should provide a durable seal for random cracks; (2) the polysulfide sealant should provide durable sealing for contraction joints; (3) the rubberized asphalt mastic will be durable only if protected from the weather and if applied in a deep section; (4) application conditions are less critical for asphalt sealers than for synthetic rubber materials; and (5) the shape factor is a lesser consideration in joint sealers than in crack sealers. (USBR)
W70-02137

COMPARISON TESTS OF STEEL PIPE COATINGS,
East Bay Municipal Utility District, Oakland, Calif.
Lee B. Hertzberg, and Arne E. Westerback.
J Amer Water Works Ass, Vol 61, No 7, p 343-346, July 1969. 4 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Steel pipes, *Protective coatings, *Corrosion control, Corrosion, Field tests, Coatings, Laboratory tests, Polyethylenes, Pipelines, *Cathodic protection.
Identifiers: *Corrosion tests, Pipe wrappings, Underground corrosion, Test results, Buried pipes, Corrosion currents.

Tests of steel pipe coatings are used primarily to predict performance in protecting the steel pipe from deterioration. Laboratory tests give a limited indication of coating performance, depending on how accurately the tests reflect field conditions. Field tests are not completely satisfactory; some doubt exists that the examined portion of pipe is representative. Frequently results are based on subjective judgment, and conclusive evaluation requires too many years, considering the rapid developments in the pipe coating industry. An ideal test should provide, in a reasonably short time and at no great cost, numerical results on coating performance and condition of coating. An ideal test procedure is proposed for coated pipe in the field, provided that the coated pipe is placed under cathodic protection at installation and that the electrical resistance of the coating is so high that soil resistance is negligible. This test is based on the assumption that the cathodic current required to maintain a pipe-to-soil potential of minus 850 mv, referenced to a copper-copper sulfate electrode, is directly proportional to coating deterioration. (USBR)
W70-02140

COOLING WATER CHEMICAL TREATMENTS,
Betz Labs., Inc., Trevose, Pa. Cooling Water Services.
For primary bibliographic entry see Field 05D.
W70-02294

09. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

MOTIVATION OF SCIENTISTS AND ENGINEERS,
Arizona Univ., Tucson.
George W. Howard.
Proc Inst Environ Sci 1969 Annu Tech Meet, Anaheim, Calif, p 584-588, Apr 1969. 5 p, 6 ref.

Descriptors: *Motivation, Management, *Engineering personnel, Research and development, *Scientific personnel, Inventions, Creativity, Employee relations, *Working conditions, Profit, Salaries, Public benefits, Human behavior, Leadership, Human engineering, Standards, Technical societies, Applied psychology, Communication, Training, Behavior (Psychology).
Identifiers: *Psychological climate, Professional advancement, Goals, Recognition, Problem solving.

Motivating an individual scientist or engineer in this day of team approach and large bureaucratic organizations requires careful placement of the individual, high standards for his performance, open channels of communications, and opportunities for career advancement. Of 22 motivating forces listed, fear was least important because of the ascendency of security in our modern society. A climate must be carefully cultivated by management to motivate an individual to optimum achievement in creativity, to encourage group cooperative effort, and to free him from noncreative work. Industry, Government, and universities are striving to permit mature individuals to make their greatest possible contributions. Research establishments in these institutions have many common problems. Management must provide guidance and friendly helpfulness to maintain the best for the professional man. A sense of urgency and public good in working on an important problem, recognition of his peers, professional advancement, opportunities for advanced training and participation in technical societies, and a sense of personal accomplishment all contribute to a highly suitable climate where an individual can develop his full capabilities. (USBR)
W70-02148

9C. Research Facilities

DESALINATION RESEARCH AT OAK RIDGE,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W70-02117

9D. Grants, Contracts, and Research Act Allotments

REPORT ON FOURTH ANNUAL WATER RESOURCES RESEARCH CONFERENCE SPONSORED BY OWRR.

Ronald R Renne, Chairman. Proc 4th Annu Water Resources Res Conf, Wash, DC, Jan 28-29, 1969. 162 p, 2 append.

Descriptors: *Water resources research act, *Water resources development, *Conferences, *Reviews, Grants, Legislation, Legal aspects, Social aspects, Laboratories, Research facilities, Governments, Planning, Projects, Research and development.
Identifiers: *Water resources research, OWRR, WRSIC.

Papers and discussions of the 4th Annual Water Resources Research Conference, January 28-29, 1969, Washington, D.C., are presented. The meeting was planned by a representative group of water resources research institute and center directors and the staff of OWRR. The conference focused primarily on updating the 10-year water resources research program and the transfer of research results. In addition to prepared papers relating to the main conference theme, papers were also presented on multidisciplinary research and on the panel report of the Office of Science and Technology on policy and institutions in water resources research. These presentations were followed by general discussion led by discussion panels. Other highlights of the meeting included a talk on the prospects of additional legislation dealing with water resources research, a report on the activities of the Water Resources Scientific Information Center, and brief reports by representatives of six geographical regions and regional research activities followed by general discussion. (Knapp-USGS)
W70-02043

PROJECTS OF THE INDUSTRIAL POLLUTION CONTROL BRANCH (FEDERAL WATER POLLUTION CONTROL ADMINISTRATION),
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-02285

10. SCIENTIFIC AND TECHNICAL INFORMATION

DESALINATION RESEARCH AT OAK RIDGE,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W70-02117

REQUIREMENTS FOR EFFECTIVE USE OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC) - DETERMINED BY FIELD EVALUATION, VOLUMES I and II,
Texas A and M Univ., College Station.
John B. Herbich, E. B. Smith, and J. D. Benson.
Available from the Clearinghouse as PB-188 290, $3.00 in paper copy, $0.65 in microfiche. Texas Water Resources Institute, Texas A and M University, Technical Report No 23 Vol I, Nov 1969. 154 p, 3 append. OWRR Project W-103.

Descriptors: *Information Retrieval, Abstracts, Data Storage and Retrieval, Value, *Documentation.
Identifiers: *Information Services, *Information Dissemination.

FIELD EVALUATION OF POTENTIAL WRSIC USERS: A field evaluation study of user requirements for effective use of the Water Resources Scientific Information Center (WRSIC) is described. The study was made up of several components including an analysis of potential users classified by their participation in various aspects of water resources; determination of WRSIC user needs according to the type of user; determination of the cost user may pay for services and quality of service demanded; kinds of information that should be included in WRSIC; type of service requirements of potential users; and potential input to WRSIC by users. Total number of organizations interviewed by mail and by personal visits was 726 and total number of persons interviewed was 128. Mail Questionnaire was sent to 669 participants and the response was 52.9 percent. The results of the study are summarized in the graphical and tabular form. Volume II contains supplementary data for Volume I. Volume III reports on a study to assess the cost effectiveness of WRSIC services
W70-02235

REQUIREMENTS FOR EFFECTIVE USE OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC) - DETERMINED BY FIELD EVALUATION,
Texas A and M Univ., College Station. Water Resources Inst.
Eugene B. Smith, John B. Herbich and James D. Benson.
Available from the Clearinghouse as PB-188 291, $3.00 in paper copy, $0.65 in microfiche. Texas Water Resources Institute, Research Project Completion Report, Volume II, Technical Report No. 23, Nov 1969. 179 p, 2 append. OWRR Project W-103.

Descriptors: *Information retrieval, *Documentation, Abstracts, Data storage and retrieval, Value.
Identifiers: *Information Services, *Information dissemination.
Supplementary information and supporting data for the main report (Volume I) is presented in this second volume. All questionnaire forms and related material, as well as a complete report of the case study phase are included in Appendix I. Other appendices contain detailed listings of the narrative responses received for questions on the questionnaires. Tables which present a variety of statistical data pertinent to the study are also included.
W70-02236

REQUIREMENTS FOR THE EFFECTIVE USE OF THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER (WRSIC) - DETERMINED BY FIELD EVALUATION. VOLUME III,
Texas A and M Univ., College Station.
E. B. Smith, J. B. Herbich, and J. D. Benson.
Available from the Clearinghouse as PB-188 292, $3.00 in paper copy, $0.65 in microfiche. Texas Water Resources Institute, Research Project Completion Report, Texas A and M Univ, Volume III. Technical Report No 23, Nov 1969. 36 p, 2 append. OWRR Project W-103.

Descriptors: *Information Retrieval, Abstracts, Data Storage and Retrieval, Value, *Documentation.
Identifiers: *Information Systems, *Information Dissemination.

STUDY OF THE WRSIC SDI AND SWRA INFORMATION SERVICES: A study designed to analyze two information services provided by the Water Resources Scientific Information Center is described. The study was conducted to assess the monetary value and acceptability to users of the Selected Water Resources Abstracts Journal (SWRA) and the Selective Dissemination of Information (SDI) System. The results indicate that WRSIC is providing a useful and valuable service to those users who are active in the area of water resources. Comments received from the participants should provide information which will be of assistance in improving future services. This is the second of two studies conducted simultaneously and is presented in Volume III of the final project report.
W70-02237

BIBLIOGRAPHY ON THERMAL POLLUTION.
American Society of Civil Engineers, New York. Committee on Thermal Pollution.
For primary bibliographic entry see Field 05B.
W70-02410

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